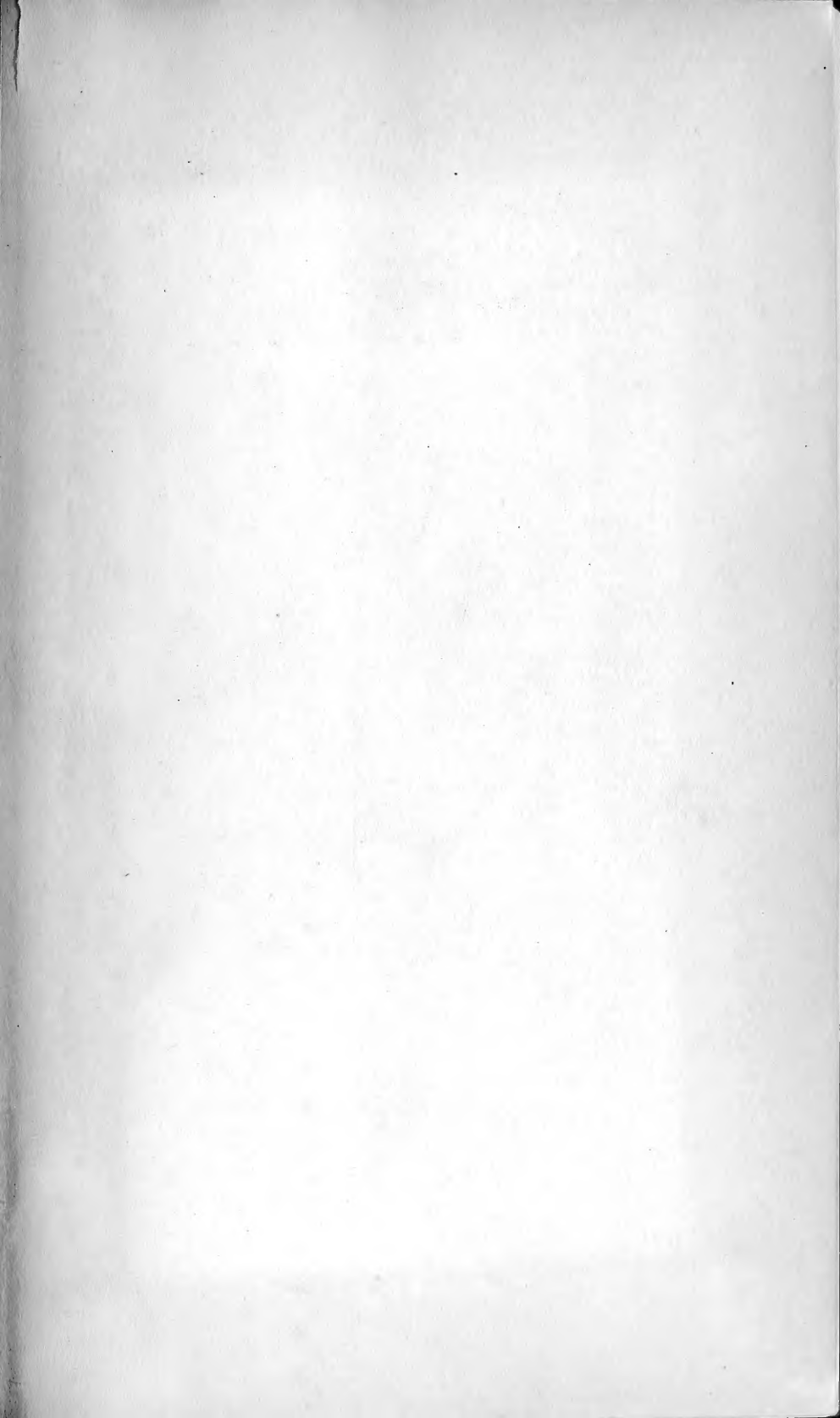


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THEODORE ROOSEVELT
1858-1919

These are Roosevelt's words on wild life research: "There must be ample research in the laboratory in order even to present those problems, not to speak of solving them, and there can be no laboratory study without the accumulation of masses of dry facts and specimens.

"I also mean that from now on it is essential to recognize that the best scientific men must largely work in the great out-of-doors laboratory of nature. It is only such outdoors work which will give us the chance to interpret aright the laboratory observations."

Roosevelt Wild Life Bulletin

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OF

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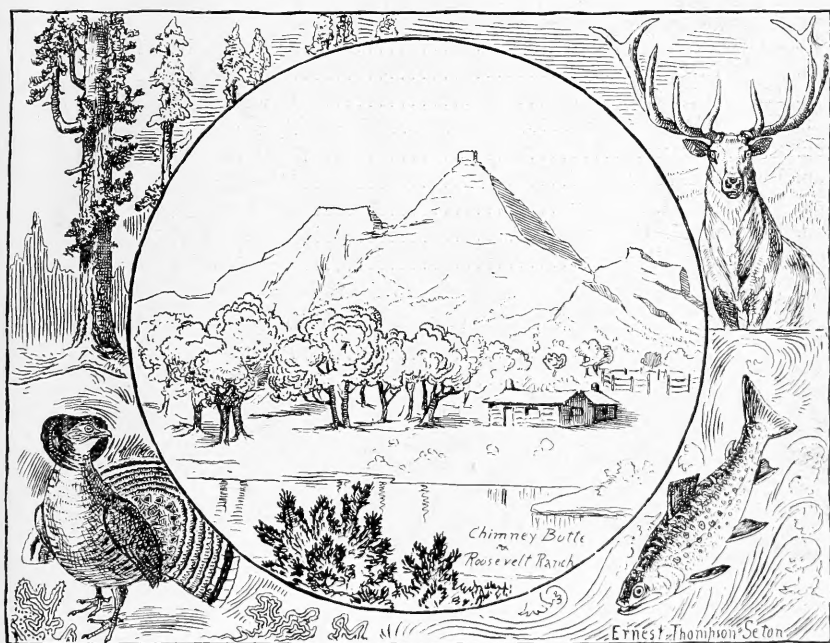
The Roosevelt Wild Life Forest Experiment Station

OF

THE NEW YORK STATE COLLEGE OF FORESTRY

AT

SYRACUSE UNIVERSITY



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* Including only those who have made field investigations and whose reports are now in preparation.

** Resigned as Station Ichthyologist October 1, 1921.

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THE RELATION OF FORESTS AND FORESTRY TO HUMAN WELFARE

"Forests are more than trees. They are rather land areas on which are associated various forms of plant and animal life. The forester must deal with all. Wild life is as essentially and legitimately an object of his care as are water, wood, and forage. Forest administration should be planned with a view to realizing all possible benefits from the land areas handled. It should take account of their indirect value for recreation and health as well as their value for the production of salable material; and of their value for the production of meat, hides, and furs of all kinds as well as for the production of wood and the protection of water supplies.

"Unquestionably the working out of a program of wild life protection which will give due weight to all the interests affected is a delicate task. It is impossible to harmonize the differences between the economic, the esthetic, the sporting, and the commercial viewpoint. Nevertheless, the practical difficulties are not so great as they appear on the surface."

HENRY S. GRAVES,

Former Chief Forester, U. S. Forest Service.

Recreation, Vol. 52, p. 236, 1915.

RESEARCH ON WILD LIFE

"The discovery of new species and races based upon the study of preserved specimens of game animals, has already progressed very far; but the more attractive field which includes the habits of the game remains yet to a great extent unexplored. This field is peculiarly open for investigation to big-game hunters, and to all other men who go far afield and obtain first-hand knowledge of the conditions under which the game animals live. The closet naturalist, with his technical knowledge of the structure of animals, can be trusted to perform the work of classification to a mathematical degree of precision; but we cannot obtain from him a trustworthy account of the behavior of animals in their natural environment, or learn from him the value to the animals of the various structures or characteristics which he has shown them to possess. Much knowledge regarding the habits of game is acquired by the successful sportsman. Yet it is often infinitesimal in quantity compared to what may be acquired if the outdoors observer will direct his investigations along the broad lines covering the life-history of the species with which he comes in contact. To carry out such investigations successfully it would be necessary to spend many hours and days, perhaps even weeks and months, observing certain individuals or family groups of game. This is quite beyond the limits of time allotted the average sportsman. Nevertheless much can be learned by the collected evidence from many fragmentary observations, providing only these are accurate. A great mass of accurate fragmentary observations will often spell far more progress in investigations of this kind than the observations of a few trained individuals over an extended period of time."

THEODORE ROOSEVELT and EDMUND HELLER.

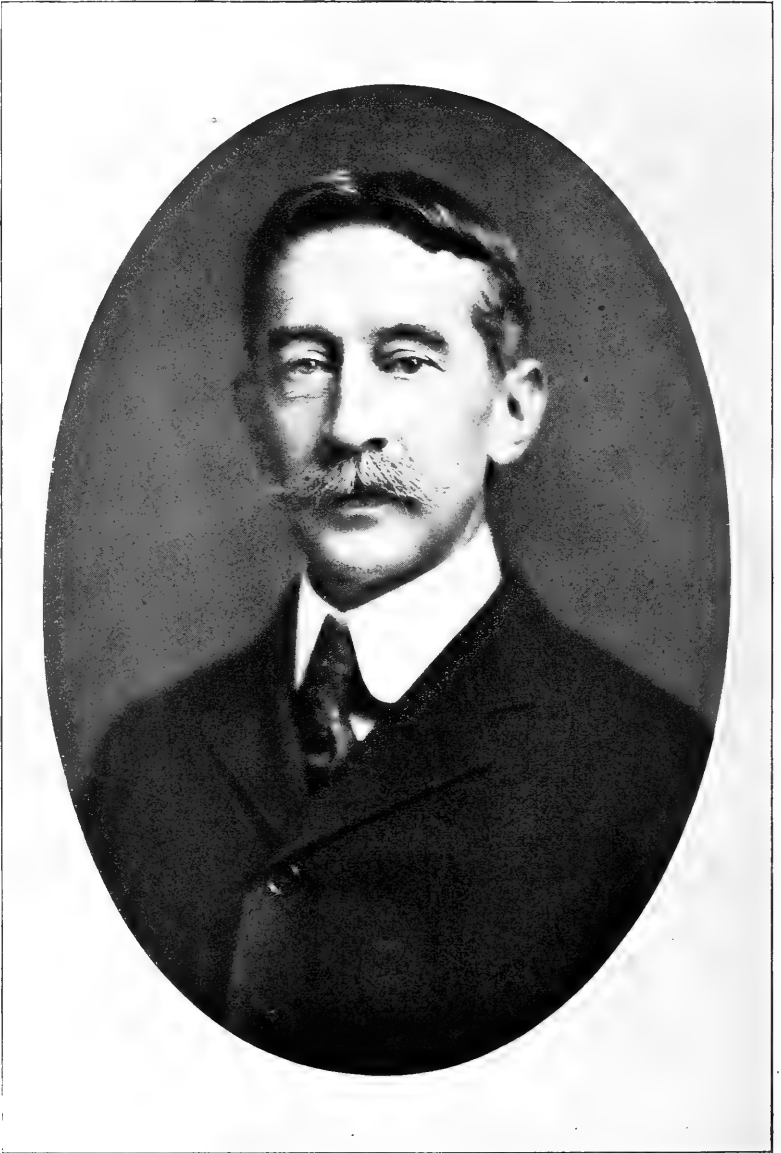
Life Histories of African Game Animals,

Vol. I, pp. vii-viii, 1914.

PURE AND APPLIED SCIENCE

"If you want improvements in industry, you may turn with confidence to applied science. If you want to revolutionize an industry or create a new one, you will do well to search the innermost recesses of the pure science laboratory."

SIR J. J. THOMSON.



GEORGE BIRD GRINNELL

Member of Honorary Advisory Council

FOREWORD

After the death of Theodore Roosevelt, a number of his friends who knew him best on the side of sport or natural history inquiry felt very deeply that there should be established for him as a memorial an institution which should carry on a work that was very near his heart—an inquiry into certain phases of natural history in which he had always been interested. Chief among these was an investigation into various processes of wild life and especially into the life history of animals. Such studies would have scientific value and might lead up to matters of economic importance.

A suggestion to this effect was made to the committee having the Roosevelt Memorial in charge but did not appear to meet with favor, and those advocating it thought it undesirable to take any action which might seem to be in opposition to the wishes of the Memorial Committee.

Since Colonel Roosevelt's death, the Roosevelt Wild Life Forest Experiment Station has been established and has done good work. Its plan had been submitted to Colonel Roosevelt, who thought so well of it as to advocate it to some of his associates and to bring it before the Boone and Crockett Club. Its work is in line with the thought of some of Colonel Roosevelt's closest friends, and is of a character that would have greatly interested Colonel Roosevelt. The Station occupies a field not filled by any other institution in the State, and carries on research work on a scale not done elsewhere.

I feel that this Experiment Station deserves the support of all scientific men and of all lovers of outdoor life, and my personal feeling is that its work may profitably be extended beyond the limits of the State which authorized its establishment.

The average field-naturalist tends to become a collector of specimens rather than an investigator of the ways of animal life. His ambition is to collect the specimens as soon as he can, and as many as he can; and fearing lest each specimen shall escape him and be lost, he neglects the opportunity to observe it in life and to learn something about its habits and its ways. Often he takes this attitude from the institution for which he is working. It desires a great series of specimens which he feels he must secure. Yet the collecting of a large series of specimens, and the bringing them

home in satisfactory shape, should be only a small portion of the field-naturalist's work. Skins and skulls are useful, but skins and skulls and measurements and proportions tell us only a little about the living animal. Most of us wish to learn something about its ways of life.

I hope for great things from the Roosevelt Experiment Station; and I hope for them not only for the great service that this Station may render to science, but because this good service will be rendered in the name of one of the great field-naturalists of this country who was interested not only in science but above all in the betterment of America and of its people in every way.

No one more than Theodore Roosevelt appreciated the value of the work done and to be done by the field-naturalist. No one more than he would welcome those services to science that may be accomplished by the Experiment Station that bears his name.

GEORGE BIRD GRINNELL

ROOSEVELT WILD LIFE STATE MEMORIAL

BY DR. CHARLES C. ADAMS

*Director, Roosevelt Wild Life Forest Experiment Station,
Syracuse, N. Y.*

With the passing of Theodore Roosevelt the nation and the world naturally turned to estimate his place in the galaxy of great men. He was the most thoroughly and widely informed man of his time, and was aware of the significance of his own acts as few men in history have been. He did not drift about; he worked in whatever direction forward movement could be made toward a clearly defined goal. He reduced random movements to a minimum and took every possible advantage to hasten progress. The chemist and physiologist calls a substance a catalyzer or enzyme which hastens changes which otherwise proceed slowly, and there is no better word to describe Roosevelt's influence. His effect was that of a good yeast. He speeded up progress, which without him would have required many more years for accomplishment. For example, the Panama Canal would ultimately have been dug by some one, but not in our generation, and very probably not so much to the advantage of the United States.

The magnificent grasp which he possessed of historic events and of existing social, economic and political conditions of the world, made it possible, with his mental poise, to estimate, as has been said, very accurately the value of his own work. Evidently his chief method of procedure was to find out what was of the greatest importance, and then get behind it and work to the limit of his ability.

What was his supreme achievement? Some students of public affairs hold in highest esteem the influence which Roosevelt's idealism exerted on our public life. This was of the highest order and belongs in the same supreme place with that of Washington and Lincoln. He made concrete to our generation the living standards of these men as no other man has done. Others consider the Panama Canal as his greatest achievement, and still others his conservation program—the proper or highest use of nature's bounty for the best welfare of the people. It seems to me that this is

unquestionably his supreme achievement, because in it is the culmination or climax of his whole constructive national program.

In view of these considerations let us bear in mind that the supreme memorial to him is the life he lived and the work itself, as Lincoln said of the soldiers' lives given at Gettysburg. All other kinds of memorials worthy of the name should aim to continue the kind of work for which Roosevelt lived and strove. Let us fully realize this and proceed to do what is best, from this standpoint. We must expect considerable divergence of opinion, depending upon the variations in human nature, but in the minds of many a most appropriate memorial to Roosevelt would combine and recognize not only his public service but as well his distinctive personal qualities and likings. All grant that he was a statesman, a scholar, a hunter, and a field-naturalist. He was a field-naturalist first, and later became a scholar and statesman. He never outgrew his first love for wild nature and wild things of the field and forest. This knowledge of nature was the fertile soil upon which grew his conservation plans, which he developed in cooperation with Gifford Pinchot, the forester.

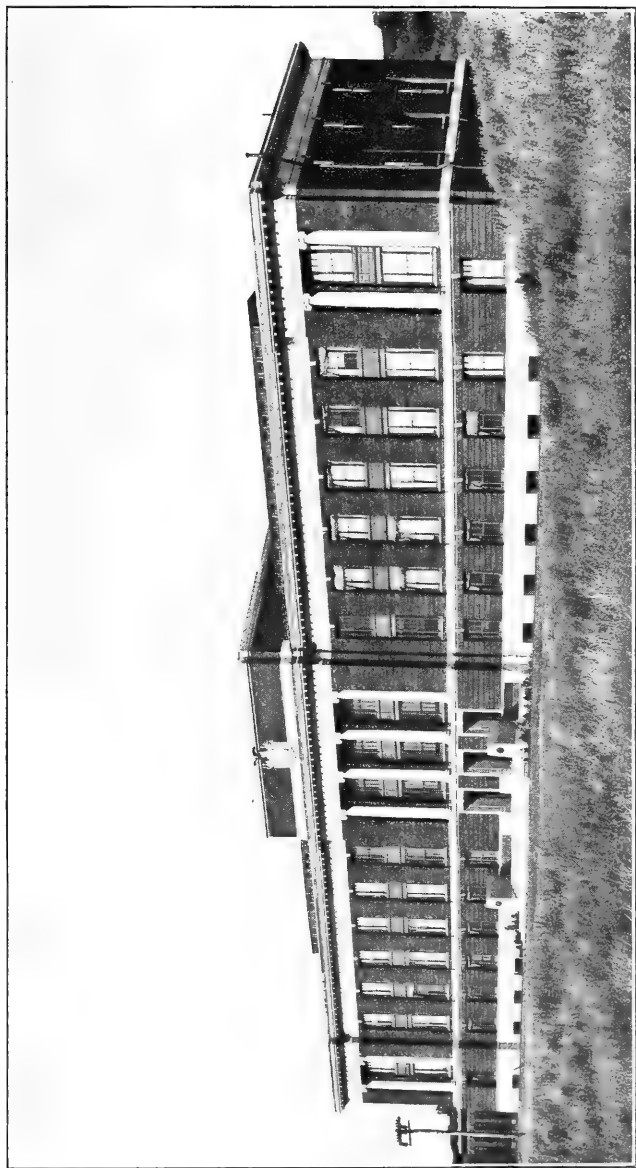
A memorial therefore which would help perpetuate one of Roosevelt's greatest achievements, namely, his conservation program as applied to forestry, including wild life, and which would promote a wide public interest in natural history studies, the subject "always uppermost in his mind," would be truly distinctive and worthy. Roosevelt himself has said:

"From now on it is essential to recognize that the best scientific men must largely work in the great out-of-doors laboratory of nature. It is only such outdoors work which will give us the chance to interpret aright the laboratory observations. . . . There must be ample research in the laboratory in order even to present those problems, not to speak of solving them, and there can be no laboratory study without the accumulation of masses of dry facts and specimens."

Here, in Roosevelt's own words, are the essential features for a plan to advance our knowledge of forest wild life by a balanced combination of outdoor study and laboratory research.

The Establishment of the State Wild Life Memorial

The Roosevelt Wild Life Forest Experiment Station of the New York State College of Forestry at Syracuse was authorized by the legislature in May, 1919, and has the unique distinction of being



The New York State College of Forestry, Syracuse, containing the offices and laboratories of the Roosevelt
Wild Life Forest Experiment Station.

a memorial which was adapted from plans which had been presented to him for the study of wild life and which Roosevelt himself had approved. These plans were presented to him in December, 1916, by the College of Forestry and received his hearty commendation. He urged that they should be developed "in a big way," and began active work for them. We then went into the war and the subject was dropped temporarily, but with his death the Trustees of the College asked the Legislature to make these plans a nucleus for the Roosevelt Wild Life Forest Experiment Station. This was done, as has been stated, in May, 1919.

The law establishing the station reads as follows:

"To establish and conduct an experimental station to be known as "Roosevelt Wild Life Forest Experiment Station" in which there shall be maintained records of the results of the experiments and investigations made and research work accomplished; also a library of works, publications, papers and data having to do with wild life together with means for practical illustration and demonstration, which library shall, at all reasonable hours, be open to the public."

Thus New York State has definitely committed herself to this wild life Memorial to Theodore Roosevelt. From the Roosevelt family came the following hearty approval, through Lieutenant-Colonel Theodore Roosevelt, Jr.:

"I think your ideas are excellent and I know that my father would appreciate no type of memorial more than that which you suggest, as you know it was one of the subjects that was always uppermost in his mind. I give my consent without reservation for the use of his name for this memorial."

The appropriateness of the Memorial has been confirmed by a number of close friends and admirers of Roosevelt who had worked with him for many years in his campaigns for conservation. It is especially fitting that the Station should be located at the State College of Forestry at Syracuse because the College emphasizes modern forestry, which consists in using forest regions to the best human advantage. This includes not only the timber, but the fish and game which can be used for food and recreation, and any other crops, such as forage for grazing animals, and even a harvest of furs. It is a broad policy, but it is the only one yet discovered that is economically and socially sound.

It is also fitting that the Station should be located here for certain additional reasons: first of all, because the plan having Roose-



Fig. 1. The field party of the Roosevelt Wild Life Station at camp on Mount Marcy, working in cooperation with other scientists.

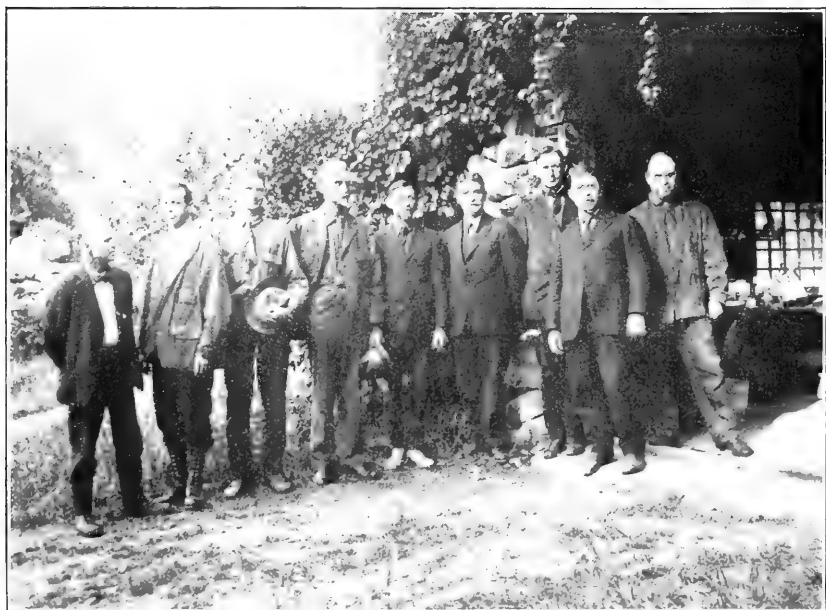


Fig. 2. A field party of the Roosevelt Wild Life Station, working on wild life problems in the Palisades Interstate Park, in cooperation with the Park Commissioners and the U. S. Bureau of Fisheries

velt's approval originated at the College; second, because the wild life problem is primarily a forest or non-agricultural land problem, for which adequate provision had not previously been made. There was no experiment station devoted solely to the requirements of the 14,000,000 acres of non-agricultural lands and waters in the State, although the agricultural needs were already fairly well supplied by experiment stations and farms; third, because the College is a New York State institution bound by its charter to conduct research and education in *all phases* of forestry; and fourth, because the Roosevelt Wild Life Station is solely a research institution, and is, therefore, more intimately related to education than to any administrative department of the State service. The State has already developed at Syracuse the largest and best equipped plant for diversified forestry education in America.

The Duties of the Roosevelt Wild Life Station

The duties of the Roosevelt Wild Life Station are to investigate, by all possible methods, our forest wild life: including the habits, life histories, methods of propagation and management of fish, birds, game, food and fur-bearing animals. The Station is thus primarily devoted to *increasing our knowledge* of forest wild life, by both outdoor and laboratory study which will develop new or improved methods of increasing the forest production of fish, fur and game animals and show their application to general forest management. The Station, therefore, supplements all State administrative agencies in forest wild life work and does not in practice duplicate that of any other State scientific department. Any incidental overlapping might even be beneficial if different methods of approach were used.

Since the establishment of the Station it has taken over the forest wild life investigations already under way in the Department of Forest Zoology at the College and has enlarged and extended them. Thus the fish surveys of Oneida Lake, of Cranberry Lake in the Adirondacks, and of the waters of the Palisades Interstate Park and Erie County have been taken up or continued, and similar work will be extended to other parts of the State as rapidly as funds will permit.

The investigations begun in the Adirondacks, on the relation of birds to the protection of the forest, have been extended to the Palisades Interstate Park. Hon. Louis Marshall, President of the

Board of Trustees of the College of Forestry, gave loyal support to the migratory bird treaty with Canada, upon the basis of the protective value which birds give forests in destroying harmful insects. The decision of Justice Holmes, of the United States Supreme Court, acknowledges the value of this kind of forest protection. This is only one phase of the special work to which the Station is devoted, and it is a fine example of the kind of research which will guide the State and nation in enacting just and constructive legislation and making wise decisions in our courts.

For several years the College has advocated the investigation of the game vermin of the State and means for its control, but funds have been lacking to advance this work. Now it is hoped that the Station can make a good start on this important problem and determine the relation of game vermin to the problem of fur production, as well as its relation to game management. A scientific study is needed of the winter life of the Adirondack deer; and the beaver problem in the Adirondacks is also in urgent need of careful *technical study*, from the standpoint of the forest trees, of water storage, as well as its influence on trout.

The fur industry in the State is in vital need of scientific guidance with regard to the natural history of our fur-bearing animals. The sudden rise of New York City to leadership in the dressed fur markets of the world is an event of great importance, only slightly appreciated by many. We have never had a careful study of the chief fur-bearing animals of the State, such as the muskrat, skunk, and the raccoon. The Station has made a start on these problems and deserves hearty support from all who are interested.

These are but a few examples of the kind of work in which the Roosevelt Wild Life Forest Experiment Station is now engaged, or for which it is making comprehensive plans. These suffice to indicate what the Station is doing in various parts of the State in attempting to solve the more practical and urgent problems concerned with forest wild life, and in such manner as to make the Station a worthy memorial of New York State to Theodore Roosevelt.*

* Reprinted by permission of Mr. James Malcolm, Editor, from *State Service* (Magazine), Vol. 5, pp. 57-60, 1921.



MRS. CORINNE ROOSEVELT ROBINSON

Member of Honorary Advisory Council

APPROPRIATENESS AND APPRECIATION OF THE ROOSEVELT WILD LIFE MEMORIAL

DR. CHARLES C. ADAMS, DIRECTOR

The establishment of a wild life Memorial to commemorate Roosevelt's interest in and achievements for forest animals seems a very natural response to everyone acquainted with him. Its appropriateness is emphasized most strongly by those who were closest to him.

Indorsements

In response to a request for the use of the Roosevelt name, Lieutenant-Colonel Theodore Roosevelt wrote: "I know that my father would appreciate no type of memorial more than that which you suggest, as you know it was one of the subjects that was always uppermost in his mind. I give my consent without reservation for the use of his name for this memorial."

Captain Kermit Roosevelt wrote as follows: "I was very much pleased to learn of the foundation, as it is the sort of activity of which my father would heartily have approved, and should play an important and useful part in the study and preservation of our wild life."

Mrs. Corinne Roosevelt Robinson, on her recent visit to the Station expressed her enthusiastic approval of its aims and gave assurance of the fitness of this memorial to her brother.

Dr. George Bird Grinnell, the Nestor of American sportsman-naturalists, and a life-long friend and co-worker of Roosevelt, wrote, May 19, 1919: "Some of us feel very deeply that in this project Mr. Roosevelt would have felt an interest far keener than in the various monuments of which we now hear so much and which no doubt will be carried through. . . . It seems to me that there is no limit to the good that may be accomplished by it, and this appears to be the first active step in a work that will receive more and more attention in this country. . . . My long friendship with Theodore Roosevelt gives me a peculiar interest in this Station on sentimental grounds; and my life-long experience in promoting the protection of natural things on purely economic grounds justifies my faith in your work, and leads me to hope that your plea for support may be successful."

Hon. Henry L. Stimson, former Secretary of War, wrote: "I sympathize with the purpose of making your Station a Memorial to Theodore Roosevelt. I know his sympathy and interest in that kind of work, and I feel it is just the kind of purpose in which he would take deep and lasting interest."

Mr. Edmund Heller, Roosevelt's companion on his African hunting trip, and joint author with him of *The Life Histories of African Game Animals*, wrote: "The Roosevelt Wild Life Forest Experiment Station, the Memorial to Theodore Roosevelt, is just the sort of memorial of which he would have approved. . . . Nothing would have brought more joy to Roosevelt's heart than the establishment of a Wild Life Experiment Station such as you have, where animals can be studied free from artificial conditions. . . . It seems particularly fit that this institution should commemorate such a man as Roosevelt, whose keenest enjoyment in life was the pursuit and study of animals in their native haunts."

Mr. Horace M. Albright, Superintendent of the Yellowstone National Park, writes: "I have read your bulletin on the Roosevelt Wild Life Forest Experiment Station and have found it most interesting. You have undertaken a great public work and it deserves the support of every section of the country, and particularly does it deserve the encouragement of every Government institution that is interested in the conservation of forest wild life; and as superintendent of our greatest game-preserve, Yellowstone Park, I hope that you will call on me for any aid that you think I am capable of giving to the Experiment Station."

Dr. William T. Hornaday, Trustee, Permanent Wild Life Protection Fund, a life-long champion of wild life protection, writes as follows: "I give my most cordial indorsement to the aims and purposes of the Roosevelt Wild Life Station, and I regard it as a very necessary factor in the fight for better preservation and better utilization of the wild life of the State."

The indorsement and commendation of this Memorial bring out clearly its appropriateness and unique character, and are an assurance by the highest authority that it stands for Roosevelt's distinctive personal interest, as well as for a large and important part of his conservation program, paving the way for an intelligent use of forests and forest wild life. Still another distinguishing and commendable feature of the Station is that it is an adaptation of plans for wild life research which Roosevelt himself approved, as will now be shown.



Fig. 1. The game laboratory of the Roosevelt Wild Life Station, with a temporary game exhibit.



Fig. 2. The office of the Ichthyologist, Roosevelt Wild Life Station.

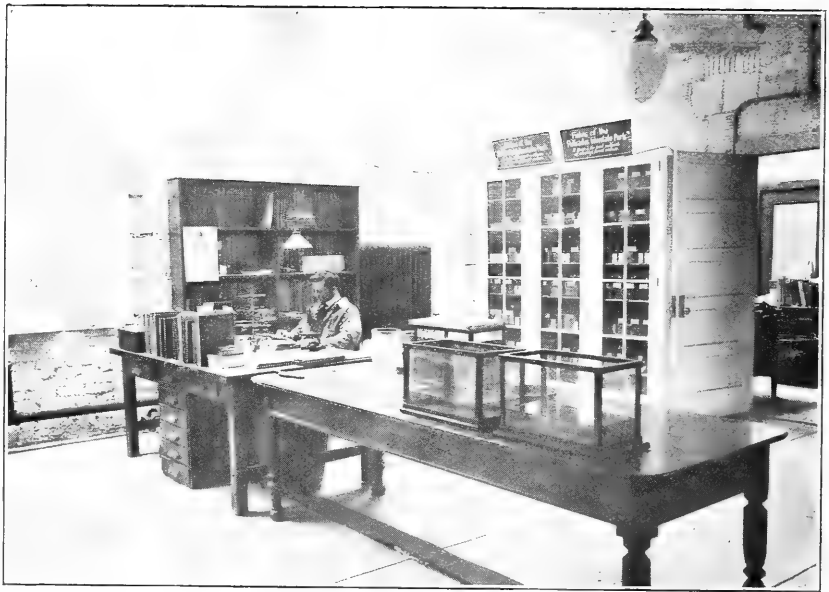


Fig. 1. The fish laboratory of the Roosevelt Wild Life Station.



Fig. 2. Another view of the fish laboratory, showing methods of storing the collections.

Roosevelt's Approval of the Original Plans

That Roosevelt himself heartily approved not only of wild life research in general but of the general program which is now the foundation of this Memorial Station, is, as has been stated, its most distinctive feature.

A brief plan for research in wild life was presented to Mr. Roosevelt on December 29, 1916. He at once approved the idea, and suggested that as a member of the Executive Committee of the Boone and Crockett Club he would gladly present this matter to the Committee at an early meeting, and requested that I write him a fuller statement. This plan was outlined in my letter to him of January 8, 1917, as follows:

"In response to your recent request for a working plan for the scientific investigation of the life history and natural history of the large game and fur-bearing animals, I would suggest the following:

STATEMENT OF THE PROBLEM

"In view of the fact that there are several organizations and endowments devoted solely to the protection and propagation of the large game and fur-bearers, and none devoted solely to the investigation of their life history and natural history, it is evident that this field is greatly neglected. I know of no one whose time is devoted solely to this kind of investigation.

"The present critical economic condition will certainly influence these animals. The recent organization of our National Park Service, and the extensive area of National Forests suitable for large game, and the impending crisis of the beaver problem in New York, are examples which show the urgency of scientific investigation of those problems by technically trained men before the management and administration of these animals in preserves and forests can be executed intelligently.

"While of course considerable is known about the life histories and habits of our larger animals, yet much more remains to be learned about even the beaver, possibly the best known species. At present our knowledge of these larger animals is very superficial indeed, when compared with what is known of many harmful insect pests, such as the Chinch Bug, Rocky Mountain Locust, and the San Jose Scale. We are passing through an important awakening as to the value of wild animals, and yet we have no generally recognized policy for the management of animal sanctuaries because we know so little about the larger dominating species.

"Special attention should be called to the fact that emphasis is here placed not on the technical details of species and varieties (a subject which for the North American fauna has reached the

point of 'diminishing returns') but on the activities of the living animal and its relation to the real world in which he lives.

"There is thus an urgent need for scientific research. How can this be best favored?

PROPOSED REMEDY

"Our larger universities, as a rule, have ignored the investigation of the larger game animals, and at present there is no indication of an early change of policy. The larger animals of the forest have for ages been considered as one of the regular products of the forest, or as Chief Forester Graves of the Forest Service has expressed it: 'Wild life is largely a forest product. It should be regarded as a public resource, to be protected and systematically developed. It is a resource which is easily destroyed under abuse; but it readily responds to right treatment. The intelligent fostering of the valuable wild life of the forest is and has always been one of the objects of forestry. Forests are more than trees. They are rather land areas on which are associated various forms of plant and animal life. The forester must deal with all. Wild life is as essentially and legitimately an object of his care as are water, wood, and forage. Forest administration should be planned with a view to realizing all possible benefits from the land areas handled. It should take account of their indirect value for recreation and health as well as their value for the production of salable material; and of their value for the production of meat, hides, and furs of all kinds as well as for the production of wood and the protection of water supplies.'

"The relation of game to forests is thus seen to be a permanent one and not a temporary alliance. It should not depend upon the favor of a few men who happen to be interested, for it is based upon mutual fundamental interests and therefore there should be a definite policy looking forward to permanent results. The most promising methods of favoring research on these large game animals are:

"First, to utilize trained men. To put into the field such available trained men as can be secured to investigate important and urgent problems. These men should be used while younger men are in training.

"Second, train young men. By means of fellowships young men can be encouraged to get the necessary training to become technical investigators of large game animals.

"It would be the part of wisdom to utilize both of these methods at some educational institution where emphasis is put upon research."

At a meeting of the Directors of the Boone and Crockett Club soon afterward a special committee was authorized to consider this plan, composed of Dr. Lewis Rutherford Morris, chairman, acting

with Major W. Austin Wadsworth, president of the Club. Dr. Morris then wrote me, "The club took much interest in the matter . . . which you set forth in your letter, and in favor of which Mr. Roosevelt spoke very strongly at the meeting." The committee then requested that the plan be presented to the Club at its annual meeting on February 8, 1917. The general plan presented to the Boone and Crockett Club at this meeting, except for certain financial estimates and other business items, is republished just following this article (pp. 35-41), under the title "Suggestions for Research on North American Big Game and Fur-Bearing Animals."

In response to a letter sent to Colonel Roosevelt with a request for suggestions, came this reply, dated January 18, 1917, which was quite characteristic: "I would not know what plan to suggest to you. Morris and Wadsworth are both big fellows; to whom you can talk in a big way, and put the case frankly before them. . . . It was a real pleasure to bring the matter before the Club and get Dr. Morris to take it up." This statement expresses very clearly that he believed the plans should be developed in a "big way." We have in these words Roosevelt's approval of the general project now being carried on. No other program would prove a more worthy Memorial of the man.

The Boone and Crockett Club, on April 25, 1917, passed the following resolution:

"Whereas, Professor Charles C. Adams, of The New York State College of Forestry at Syracuse University, has brought to the notice of the Executive Committee of the Boone and Crockett Club a plan for the scientific study of the life-habits of the fur-bearing and large mammals of North America,

"Resolved, That this committee heartily approves this plan, and believes the results of such an investigation would be of vast scientific interest and probably of great economic value."

(Signed) KERMIT ROOSEVELT,

Secretary of the Boone and Crockett Club.

LEWIS R. MORRIS,

Chairman of the Special Committee.

With the entrance of the United States into the World War on April 6, 1917, it was decided to reserve this plan of research for development at a more favorable time. The armistice was signed November 11, 1918, and Roosevelt died soon after, on January 6, 1919. These plans for research had, throughout, the hearty support



THEODORE ROOSEVELT

Member of Honorary Advisory Council

of Dr. Hugh P. Baker, then Dean of the College of Forestry, who took the plan to the Trustees of the College. Inasmuch as it had originated at the College, and had had Roosevelt's approval, the Trustees considered it eminently appropriate as a Memorial, and therefore requested Senator J. Henry Walters and Assemblyman George R. Fearon to present a bill to the Legislature authorizing the establishment at the College of the Roosevelt Wild Life Forest Experiment Station. This bill was presented to the Senate and Assembly on March 26, 1919, and became a law May 10, 1919, with the approval of Governor Alfred E. Smith.

Activities of the Memorial Station

This brief account of the origin of this Memorial shows how New York State has made a very modest start indeed toward what, in the minds of many, is the most appropriate kind of Memorial to her greatest citizen; and the future must reveal what wisdom and foresight the State will show in its proper nurture. The State of New York thus becomes the guardian of this wild life Memorial to Theodore Roosevelt. The New York State College of Forestry at Syracuse, is a State institution supported solely by State funds, and the Roosevelt Wild Life Forest Experiment Station is a part of this institution. The Trustees are State officials. A legislative mandate instructed them as follows:

"To establish and conduct an experimental station to be known as 'Roosevelt Wild Life Forest Experiment Station,' in which there shall be maintained records of the results of the experiments and investigations made and research work accomplished; also a library of works, publications, papers and data having to do with wild life, together with means for practical illustration and demonstration, which library shall, at all reasonable hours, be open to the public." [Laws of New York, chapter 536. Became a law May 10, 1919.]

Special attention should be called to this unique provision for a wild life library. We have no such public library in America devoted exclusively to this subject. The policy of the Station is to build up a comprehensive collection of publications of all kinds, including also original note books, manuscripts, photographs, drawings, and other illustrative material, technical and popular, which bear upon the use and appreciation of forest wild life.

While this Memorial Station was founded by New York State, its functions are not limited solely to the State. The Trustees of



KERMIT ROOSEVELT

Member of Honorary Advisory Council.

the Roosevelt Station are further authorized by law to cooperate with other agencies, so that the work is by no means limited to the boundaries of the State or to the use of State funds. Provision for this has been made by the law which enjoins the Trustees —

“To enter into any contract necessary or appropriate for carrying out any of the purposes or objects of the college, including such as shall involve cooperation with any person, corporation, or association, or any department of the government of the State of New York or of the United States, in laboratory, experimental, investigative or research work, and the acceptance from such person, corporation, association, or department of the State or Federal government of gifts or contributions of money, expert service, labor, materials, apparatus, appliances or other property in connection therewith.” [Laws of New York, chapter 42. Became a law March 7, 1918.]

By these laws the Empire State has made provision to conduct forest wild life research upon a general and comprehensive basis, and on a plan as broad as that approved by Theodore Roosevelt himself.

From its inception the Station has enlisted the cooperation of other State departments, first with the Commissioners of the Palisades Interstate Park, and later with the Commissioners of the Allegany State Park and the State Conservation Commission on Park wild life problems. Special investigations have been conducted with the assistance of the United States Bureau of Fisheries, in the Palisades Interstate Park and on Oneida Lake. On Mount Marcy in the Adirondacks, timber line conditions were studied with the Ecological Society of America, the Brooklyn Botanic Garden and the Vermont Agricultural Station. A fish survey of Erie County has been conducted with the Buffalo Society of Natural Sciences, the Erie County Society for the Protection of Birds, Fish and Game, and seven other allied organizations in that vicinity. Several Trustees of the College of Forestry have contributed funds for a special study of the Adirondack beaver which was made during the past summer.

In addition to the cooperation with various State departments, private organizations and individuals within the State, studies now in progress in Yellowstone National Park have been made possible through the financial support of the Yellowstone Park Camps Company and a grant from special friends, together with the assistance of the National Park Service and with the collaboration of several

field naturalists. This has provided for studies of the fish food, the beaver, and the large mammals of the Park. The original plans presented to Roosevelt made provision for just such studies in our National Parks and Forests on the broadest possible basis.

The Honorary Advisory Council

In the plans for wild life research presented to Mr. Roosevelt provision was made for an Honorary Advisory Council to assist in their execution. After the Memorial Station had been established, it was considered that this feature should be included in the present Station plans.

It was considered eminently appropriate that at this stage this Council should include only those who were close personally to Roosevelt, or who had some special interest in promoting research on wild life.

The present American members of the Honorary Advisory Council are:

Mrs. Corinne Roosevelt Robinson, New York City. By nature destined to be an intimate sharer in her brother's life work. Author of *My Brother Theodore Roosevelt*.

Theodore Roosevelt, Assistant Secretary of the Navy, Washington, D. C. Mr. Roosevelt gave consent to the use of the Roosevelt name for this Memorial Station.

Kermit Roosevelt, New York City. Companion of his father on his expeditions in Africa and South America. Author of *The Happy Hunting Grounds*.

George Bird Grinnell, New York City. Life-long friend and associate editor with Roosevelt; a founder and for some years President of the Boone and Crockett Club, of which Roosevelt was the originator.

Gifford Pinchot, Harrisburg, Penna. Leading co-worker with Roosevelt in his general conservation campaigns and in the establishment of National Forests — a chief stronghold of wild life.

Chauncey J. Hamlin, Buffalo, N. Y. Ardent supporter of Roosevelt in his political reforms, and actively engaged in constructive wild life conservation.

George Shiras, 3rd, Washington, D. C. Wild life photographer, congressman, author of the original Federal migratory bird bill, and author of the bill for the Federal protection of migratory fish.

Frank M. Chapman, New York City. Ornithologist, close friend of Roosevelt, and a leading champion of outdoor bird study.



VISCOUNT GREY

Member of Honorary Advisory Council

The European members of the Council are:

Viscount Grey, Falloden, England. Author of *Fly-Fishing*. A close student of birds, whose story of his bird outing in the New Forest with Roosevelt, as told in his essay on *Recreation*, will inspire every outdoor enthusiast.

Viscount Bryce, Forest Row, England. A close friend of Roosevelt, and keenly appreciative of wild nature; a sympathetic friend of American institutions, and our most respected and cherished European statesman.

Sir Harry H. Johnston, Arundel, England. A keen admirer of Roosevelt, a successful student of wild life, and a wilderness explorer.

Very hearty approval of the plans for the Station have come from various members of the Honorary Advisory Council. Thus Viscount Grey remarks:

"The project for a Roosevelt Wild Life Forest Experiment Station appeals to me strongly, both by the intrinsic interest of the subject and by the fact of its being a memorial of one for whom I had great admiration and regard. I very much appreciate the invitation to be a member on its Honorary Council. . . . I should feel it both a pleasure and an honor to be associated with the Memorial Station in any honorary capacity that you think suitable, and I shall always be interested to hear of its progress and work."

And Viscount Bryce writes:

"I cordially appreciate your invitation to become a member of the Honorary Advisory Council proposed to be created, and as I assume that membership thereof does not involve active duties, which of course my residence in England would not permit me to discharge, I have much pleasure in accepting the honor." He further adds that he is in "heartly sympathy with the work described [in publications sent to him] and with every plan for preserving wild life and the untouched aspects of Nature. Theodore Roosevelt did admirable work in that line, and I rejoice to learn that the impetus is not declining."

Sir Harry H. Johnston writes similarly:

"I feel myself both honoured and gratified at being selected as an Honorary Advisory Councilor of the Memorial to Theodore Roosevelt's intense interest in the beauties and wonders of United States wild life and natural scenery. You are right in supposing that he exercised considerable influence on my mind in regard to interest in American scenery and the preservation of American wild

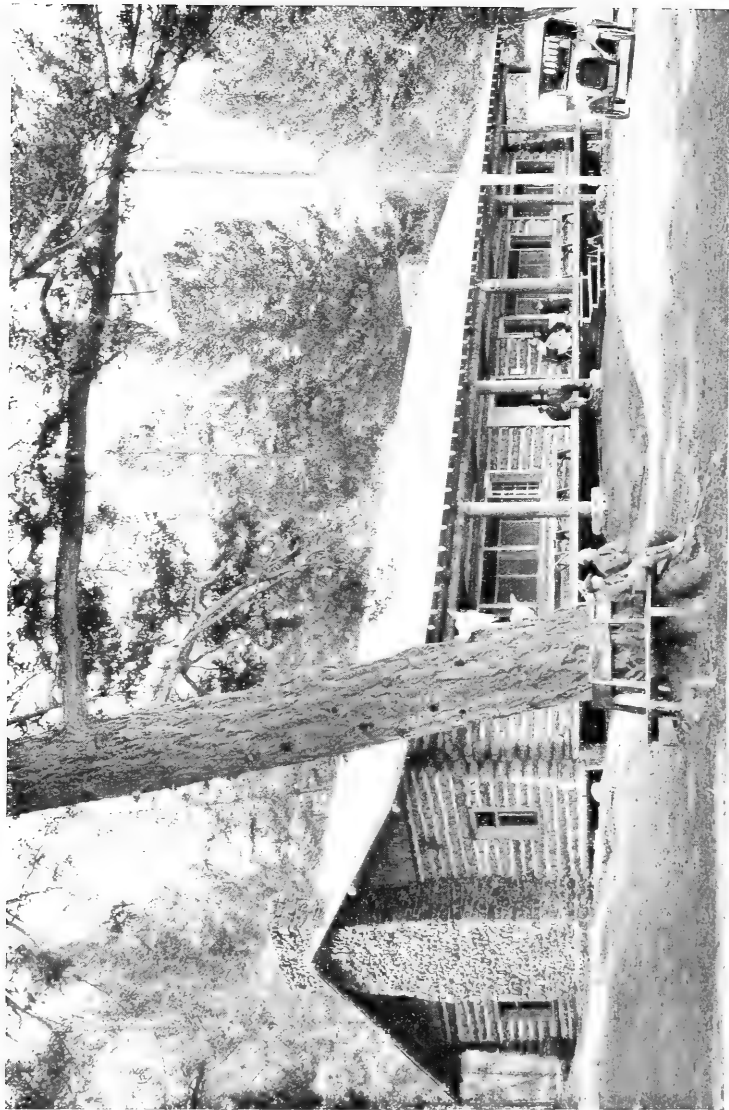
life. . . . If, without being impertinent, I might make some expression of my hopes, it would be that this commemorative influence of Roosevelt might spread far beyond New York and New England into those States of unappreciated natural beauty, Georgia, Alabama and Louisiana, in time to save their splendid magnolia forests from destruction."

That the Station should not be limited to New York State is the opinion expressed by many persons who are unaware that this feature is already provided for by law.

An editorial in *Forest and Stream* reads thus:

"Three years ago the authorities of the New York State College of Forestry submitted to Colonel Theodore Roosevelt plans for an inquiry into the wild life of the New York forests, and received the promise of Mr. Roosevelt's hearty support and that of a number of his friends and associates. The establishment of the Roosevelt Wild Life Forest Experiment Station marks the first active step in a movement . . . likely to go far in the United States. . . . The work of the Roosevelt Experiment Station will thus consist of experiment, investigation, and general research into the wild life which occupies millions of acres of land and water. . . . For some years work of this character has been urged upon the Interior Department, and in a tentative way has even been undertaken by the National Parks Service. . . . The work that such an experiment station may do is almost limitless, and its possibilities are as yet quite beyond the range of our imagination." (Vol. 89, p. 409, August, 1919).

In concluding this brief account of the history of this Roosevelt Memorial, too much emphasis cannot be put upon its unique features. It is the only existing Memorial that has been built upon a plan that had Theodore Roosevelt's personal approval. There is unanimous agreement among those who were closest to Roosevelt, and who shared his interests in wild life, that this is the most appropriate kind of Memorial to him. The State of New York is the guardian or trustee of this Memorial, has made a comprehensive plan for its future development, and now awaits the execution of this plan in a manner worthy of her greatest citizen.



Field headquarters of Roosevelt Wild Life Station party, at Camp Roosevelt, Yellowstone Park, 1921,
Courtesy Forest and Trail Camp.

SUGGESTIONS FOR RESEARCH ON NORTH AMERICAN BIG GAME AND FUR-BEARING ANIMALS

Presented by request to the Boone and Crockett Club

BY DR. CHARLES C. ADAMS

Professor of Forest Zoology, The New York State College of Forestry at Syracuse University

Introduction

Statement of the Problem. In view of the fact that there are several organizations and endowments devoted solely to the *protection and propagation* of large game and fur-bearers, and *none* devoted solely to the investigation of their life history and natural history, it is evident that this field is greatly neglected. I know of no one whose time is devoted solely to this kind of investigation.

The recent organization of our National Park Service, and the extensive area of National Forests suitable for large game, and the impending crisis of the beaver problem in New York, are examples which show the urgency of scientific investigation of these problems by technically trained men before the management and administration of these animals in preserves and forests can be executed intelligently.

While of course considerable is known about the life histories and habits of our large mammals, yet much remains to be learned about even the beaver, possibly the best known woodland species. At present our knowledge of these larger animals is very superficial indeed, when compared with what is known of many harmful insect pests, such as the Chinch Bug, Rocky Mountain Locust, and the San Jose Scale. We are passing through an important awakening as to the value of wild animals and yet we have no *generally recognized policy for the management of animal sanctuaries because we know so little about the larger dominating species.*

Special attention should be called to the fact that emphasis is here placed not on the technical details of species and varieties (a subject which for the North American fauna has reached the point of "diminishing returns") but on the *activities of the living animal and its relation to the real world in which it lives.*

There is thus an urgent need for scientific research. How can this be best favored?

Proposed Remedy. Our larger universities, as a rule, have ignored the investigation of the larger game animals, and at present there is no indication of an early change of policy. The larger animals of the forest have for ages been considered as one of the regular products of the forest, or as Chief Forester Graves of the United States Forest Service has expressed it: "Wild life is largely a forest product. It should be regarded as a public resource, to be protected and systematically developed. It is a resource which is easily destroyed under abuse; but it readily responds to right treatment. The intelligent fostering of the valuable wild life of the forest is and has always been one of the objects of forestry. Forests are more than trees. They are rather land areas on which are associated various forms of plant and animal life. The forester must deal with all. Wild life is as essentially and legitimately an object of his care as are water, wood, and forage. Forest administration should be planned with a view to realizing all possible benefits from the land areas handled. It should take account of their indirect value for recreation and health as well as their value for the production of salable material; and of their value for the production of meat, hides, and furs of all kinds as well as for the production of wood and the protection of water supplies."

The relation of game to forests is thus seen to be a *permanent one* and not a temporary alliance. Progress in game should not depend upon the favor of a few men who *happen* to be interested, for it is based upon mutual fundamental interests and therefore there should be a definite policy looking forward to permanent results. For these reasons it is suggested that cooperation between those interested in game and fur-bearers and a forestry institution, The New York State College of Forestry, is based on sound logic and upon mutual advantages. The College is a State educational and *research* institution which is devoted to the utilization of all forest crops both plant and animal. It is now coming to be generally recognized that animal crops (game and fish) from forests are necessary and legitimate in forest practice, as much so as is the production of cattle on the farm.

The following provisional suggestions are intended to aid in the *selection* of a problem or problems and in the *development of a working plan*.

Proposed Research on Alaskan Big Game

The coastal region of Alaska is at present the *main home* of American big game. These animals are of exceptional interest, and in spite of the excellent work by several skilled field men they are in reality but little known. There has been no work done by resident naturalists who have lived there the year round devoting their whole time to the study of the game. This region is above all the *most important region for investigation in America*.

I would suggest headquarters for a field party on the Kenai Peninsula. With the railroad developing from Seward there is urgent need of early study of the game of this peninsula before it is too late.

It may be objected that the remoteness of the region, and the expense of working at this distance, are serious defects of this project, but *importance* of the subject, its *urgency* on account of the railroad, and the little detailed knowledge which we have of the animals, should be kept in mind.

A naturalist, with two trained assistants, a guide, and camp cook, located at a permanent camp from which local camps could be reached, would permit detailed study of the region and an intimate knowledge of the big game and of the smaller organisms upon which they are dependent.

So far as known to me no such study has ever been made of big game. It would, if carried out properly, serve as a model for other workers for years to come and would raise the standard of game study to a new and higher level.

Proposals for Eastern Big Game

In addition to the Alaskan project it is very desirable also to do some *intensive work* on the game nearer home. With this in mind the following suggestions are given with the idea of selecting the most suitable:

1. **New York Deer.** To make a detailed field study of the seasonal changes in habits, food, influence of weather, behavior during the breeding season, care of young, causes of death, normal density of deer population in forests, influence of deer upon the vegetation and allied subjects.

Such a study could be made on some of the large preserves in the Adirondacks or Catskills (possibly on property belonging to



Fig. 1. Field party of the Roosevelt Wild Life Station in Yellowstone Park, summer of 1921. Park ranger mounted.

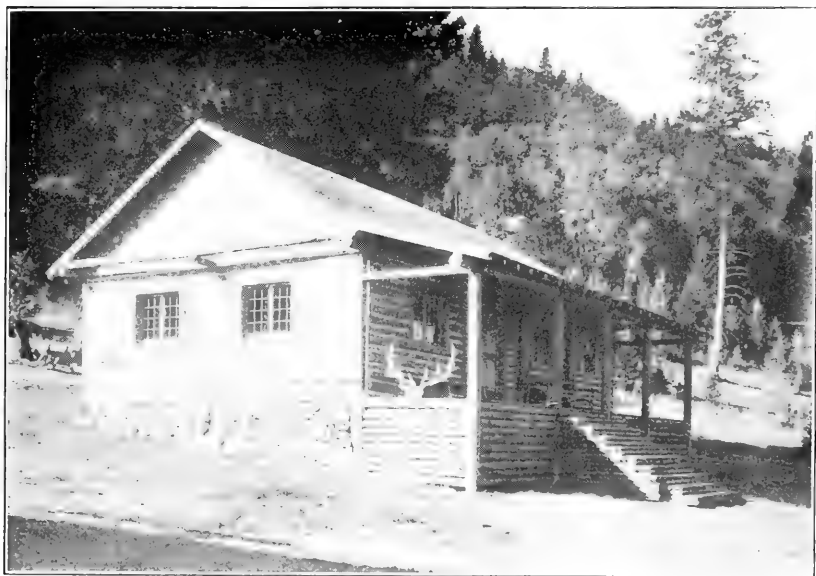


Fig. 2. Lodge at Forest and Trail Camp, shared by Roosevelt Wild Life Station field party, in the Yellowstone.

some member of the Club). A carefully selected area with diversified conditions would furnish opportunity for important results. In spite of the fact that the deer has been hunted so much and has been the basis for so much legislation, *technical studies* of it are conspicuously wanting. In fact, when we compare our knowledge of the Codling Moth of the apple and the Cotton Boll Weevil with that of the deer, it is amazing how little we really know about the deer although this is contrary to the usual impression.

2. Game Survey of the Mt. Ktaadn Region. A game survey of the Mt. Ktaadn region is desirable in order to determine the amount of game, how the species influence one another, and to secure detailed data on their life histories. Such a scientific study is needed for many reasons, such as:

a. There is some reason to hope that this might be made the best, or one of the best, big game preserves in Eastern United States.

b. Such a study might aid in the establishment of a National Park.

c. Should a Park be established such an investigation would aid in the intelligent management of the large game, and in stocking the Park properly.

d. The example of such work would stimulate other similar investigations.

3. Caribou and Moose in Eastern Canada. A study of the Caribou and Moose (and possibly of other big game) in Eastern Canada. Detailed field studies along lines similar to those suggested for the deer.

For the preceding Eastern investigations the following kind of party is suggested:

A naturalist, with an assistant and a camp hand. For the Ktaadn problem two assistants should be provided.

Possible objections to all these Eastern plans are very likely to come mainly from those who are much influenced by the mass of game literature, or who are perhaps for the time being much more interested in the propagation and protection of game than in understanding it and in advancing our knowledge of it. It is hardly necessary to mention that the mass of game literature is of a popular character and is largely pure trash, as far as science is concerned. Today we probably know more about the rat and the fur seal than any other wild mammals, and yet every one knows that our knowledge of the seal is far from complete, and the urgency of a scientific

knowledge of the rat increases every year in spite of the extensive investigations made during recent years. When, therefore, we compare what is known of these animals with that of our Eastern game and fur-bearers the contrast is very marked indeed. In spite of all we know there is urgent need of further investigation.

Proposals for Western Big Game

The large amount of big game in the West very naturally calls for suggestions for that region. Here also several are made:

1. **Big Game of the National Parks.** This might be a study of the life history of the big game in some Western National Park, such as the Yellowstone, Glacier National Park or Rocky Mountain National Park.

2. **Life History of the Mountain Sheep and Goats of Glacier National Park.** Study of the detailed life history of the Mountain Sheep and Goats of Glacier National Park.

3. **Relation of Beavers to Conservation of Water and Soil.** An important study should be made of the relation of beavers to soil, water and fish conservation in the Rocky Mountain region, including a careful measurement of the areas flooded (made with the assistance of a civil engineer), depth of soil accumulated by dams, and influence of these dams upon fish. With all that is known about the beaver, there is no recent detailed work along these lines since conservation became a live issue.

4. **Game Vermin.** A detailed study should be made of the game vermin of a *limited area* in order to get a better understanding of the character of the "balance of nature" existing between game and game vermin. No careful detailed study of this problem has ever been made in America.

This study could be made in a National Forest or Park. By means of systematic trapping of the live animals, and extensive field observations much important scientific and practical information could be acquired which would bear upon the "struggle for existence" of game. It should be made a study of their dynamic relations.

The coyote, bear and mountain lion are being destroyed at a rapid rate because of their relation to grazing, but the relation of these animals to game has not received much attention as a scientific problem.

For the preceding Western investigations the following kind of party is suggested:

1. A naturalist, with one assistant (two for the larger problems), and one or two camp helpers.

Fellowship and Scholarship Plan

In addition to the use of trained field naturalists as a means of advancing our knowledge, provision is desirable to care for a rising generation of trained men who can and will study the big game problems. At present there are no such positions in our colleges and universities, and there is a great paucity of men who are able to do field work on game animals, and who can or will publish their results. To improve this situation the establishment of Fellowships and Scholarships is urged.*

January 31, 1917.

* Reprinted; see p. 25.

WILD LIFE RESEARCH IN THE YELLOWSTONE

"This whole episode of bear life in the Yellowstone is so extraordinary that it will be well worth while for any man who has the right powers and enough time, to make a complete study of the life and history of the Yellowstone bears. Indeed, nothing better could be done by some of our outdoor faunal naturalists than to spend at least a year in the Yellowstone, and to study the life habits of all the wild creatures therein. A man able to do this, and to write down accurately and interestingly what he had seen, would make a contribution of permanent value to our nature literature."

THEODORE ROOSEVELT.

Outdoor Pastimes of an American Hunter, p. 315, 1908.



SIR HARRY H. JOHNSTON
Member of Honorary Advisory Council

THEODORE ROOSEVELT

By Sir HARRY H. JOHNSTON

The ex-President of the United States who died in the first week of 1919 was in many ways the most remarkable man I have ever met, and combined with unusual qualities of intellect and co-ordinated development of bodily skill — for was he not a fine shot, a bold equestrian, an untiring marcher, an adept at most games and sports? — a kindness and sweetness of disposition, and a thoughtfulness for the happiness and well-being of all around him, very rare in great men of the world.

He was a field-zoologist of the new school, the school which has given us J. G. Millais, Radclyffe Dugmore, Ernest Seton, C. W. Beebe, and a host of young and middle-aged Americans who have studied wild life with unswerving accuracy, seeking only to set forth the truth in real natural history, and disposing summarily of many a hoary lie and legend about wild life, scorning, moreover, the vagueness of statement and nomenclature which arises from imperfect observation and inadequate study.

Theodore Roosevelt was not only a great naturalist himself, but — what in its ultimate effect was even more important — he set, as President, the fashion in young America for preserving and studying fauna and flora until he had gone far to create a new phase of religion. Under his influence young men whose fathers and grandfathers had only studied the Bible, the sacred writings of the post-exilic Jews and Græco-Syrian Christians, now realised that they had spread before them a far more wonderful Bible, the book of the earth itself. Geology, palæontology, zoology, botany, ethnology, were part of Roosevelt's religion. He may have been a specialist in none of these branches of science, but he saw the divinity pulsating through them, more glowingly apparent than in narrow imaginings of theology.

The man's memory was prodigious. I once spent some ten days — in two separate visits — as his guest at the White House in 1908. At one luncheon party the question of Mayne Reid's novels came up. Roosevelt gave a *précis* of the more remarkable of their plots, of their characters, their defects and strong points. So he could with Dickens, Thackeray, Jane Austen, Nathaniel Hawthorne, and Mark Twain. When I was setting out to study the negro in

the New World he gave me from memory an almost complete bibliography of the works discussing the slavery question in the United States, from the books of Anthony Benezet in 1762 to those of Olmsted in 1861. Once, when the then Provost of Oriel called and lunched, and was rather perversely Hellenistic in his lore, Roosevelt, with a twinkle in his eye, turned the subject to the Tatar invasion of Eastern Europe in the thirteenth century, and gave us a really remarkable sketch of its chief incidents and ultimate results.

It would be a great mistake to represent this great man as one who monopolised the conversation in public or in private. On the contrary, he was a rarely good and encouraging listener to anyone who had something to say, and singularly courteous about not interrupting. Indeed, he drew out good conversation in those around him, besides being an exceptionally interesting talker himself.

As a writer on zoology Roosevelt is best known by his *African Game Trails* and *African Game Animals*, but his *Outdoor Pastimes of an American Hunter* (1908) is well worth reading, both for letterpress and illustrations. *Through the Brazilian Wilderness* gives a truthful, though not always exhilarating, description of the Brazilian forest and grassy plains. But there is another side to Theodore Roosevelt, and many an instance of his versatility, in the five volumes of his "Presidential Addresses and State Papers." Probably no head of a State in history has uttered so much sound sense with so much originality of diction and illustration. In Roosevelt we had for the first (and, so far, the only) time a great ruler who was also an adept in the modern sciences, a student and an exponent of the New Bible, a statesman who was extraordinarily well versed in geography — prehistoric, historical, political, physical, and commercial — who was strongly interested in botany, ethnology, zoology, philology, modern history, sociology, and questions of hygiene and the struggle for the supremacy of man over recalcitrant Nature. He gave a great impulse to the research into the causes of yellow fever, and the means of eliminating it from Cuba and Panama. If we only had the luck to acquire a Prime Minister with the learning, the driving force, and the sincerity of Roosevelt, what might not be the after-history of the British Empire, could such a Premier direct its destinies and the education of its governing classes for seven years? But, alas! Politics in Britain do not breed Roosevelts.*

* Reprinted, by permission of Sir Harry H. Johnston, and the Editor, from *Nature*, Vol. 102, pp. 389-390, January 16, 1919.



GEORGE SHIRAS, 3RD.

Member of Honorary Advisory Council



GIFFORD PINCHOT
Member of Honorary Advisory Council

ROOSEVELT'S PART IN FORESTRY

BY DR. GIFFORD PINCHOT

Instead of a formal article from me describing in a balanced way President Roosevelt's service to forestry, will you accept this discursive letter, which neither surrounds the subject nor lays measured stress upon its different parts, but just talks about the man and the leader whom we all loved. Just at the moment I am deep in an effort to defend the Roosevelt policies as to coal, oil, and phosphate, and that comes first.

Some men belong to all people and all time. I suppose it is true that Theodore Roosevelt was loved and trusted by more men and women in more lands during his lifetime than any other man who ever lived. Certainly more men and women followed him in spirit to the grave than ever did the like before for any other man in human history.

Very much of the work that Roosevelt started is yet unfinished. As his great soul goes marching on, we know that at the very heart of the goal to which it marches is that greatest of Roosevelt policies — the planned and orderly development and conservation of the natural resources of America — by no means forgetting the forest, which in a true sense is the mother of all the rest.

No matter how or where you touched him, you could not long delay in finding that Roosevelt was an outdoor man. Gifted in the highest degree with the forester's master qualities of hardiness, judgment, self-control, and the power of observation, Roosevelt brought with him to the White House so deep a sympathy with the foresters' viewpoint that it gave color and direction to all he did touching the great central problem of conservation.

There was no forester but would have liked to have him on the hardest of his trips. There was no time when his mind was not alert for the protection and advancement of the forests. His sympathy with foresters as such was well shown when he broke all presidential precedents to attend, at a private house, a meeting of the Society of American Foresters, to address its members and to meet them all personally.

Roosevelt's sympathy with forests and his genius for administration made him from the first an active and powerful supporter

of the proposal to transfer the National Forests from the General Land Office to the old Bureau of Forestry, and thus to unite the forest work of the Government under a single head. For more than three years, as I remember it, his recommendations for the transfer were made to Congress, while the personal pressure which he exerted was by far the strongest factor in our final success. Without him it would have been wholly impracticable to bring the transfer about. It was Roosevelt who made the Forest Service possible.

It tells but little of the story to say that Roosevelt saved for us more National Forests than all other Presidents put together. He not only created but defended and preserved them, and when Congress finally took from him the power to add to their number, at the last moment he saved to the people of the United States some 16,000,000 acres more of mountain forest lands. He did it by using the method which has meant so much to forestry and conservation in America, by out-thinking the opposition.

It was William T. Cox, now State Forester of Minnesota, who came to me with the suggestion that Roosevelt should save this forest land before the objectionable provision had passed both houses. When I took Cox's suggestion to him, the President approved it with enthusiasm; the Forest Service was ready; the necessary field studies had been made; the maps had been drawn; we knew what we wanted and we knew how to get it. It remained only to prepare the official proclamation for each addition to the existing National Forests.

For forty-eight hours the drafting force of the Forest Service worked night and day. As fast as they prepared the proclamations they were taken to the White House. As fast as he received them the President signed them, and sent them at once to the State Department for safe keeping. Thus Roosevelt saved from destruction and set aside for all the people an area more than half as large as the State of Pennsylvania, and did it in the short interval while the bill was passing and before it passed.

No other President has ever been, and doubtless no other ever will be, as practically familiar both with the forest and the range as was President Roosevelt. It was in the early part of his administration that the forest and grazing problem in the Southwest became the liveliest question before the Bureau of Forestry. To the huge gain of the nation as a whole, Roosevelt was thoroughly equipped

to handle it. At the recommendation of the Secretary of Interior, as I recall it, President Roosevelt made, soon after he came to the White House, a decision as to grazing on National Forests in Arizona which I thought to be unwise. Representatives of the grazing interests of that territory, including, I believe, the present Associate Forester of the United States Forest Service, came to me and set forth their objections to the President's decision. I agreed with them, and I suggested that, although the President's action had been made public, we might nevertheless put the case before him. We did so, very briefly. With his usual lightning grasp of a situation, Roosevelt saw that he had followed the wrong trail, and without the slightest care that he would be reversing himself in public, he set the matter right. I knew then that he was a great man.

It was the endless good fortune of forestry in America that while it was still young it should have had in the White House so firm, sympathetic, and understanding a friend. How much it owes to him it will never be possible accurately to determine; for the debt of forestry to Roosevelt is not to be counted only in the great things he did for it, but also in the thousands of small advances and advantages which came to American forestry because it was known to be dear to the heart of the first citizen, the greatest driving force, and the most powerful influence in America.

Forestry is firmly established among us today because Roosevelt stood behind it like a stone wall when there was little to it except hope and good intentions.*

* Reprinted, by permission of the author and the Editor, from the *Journal of Forestry*, Vol. 17, pp. 122-124, 1919.

ROOSEVELT AND WILD LIFE

BY MR. EDMUND HELLER

Naturalist, Roosevelt African Expedition

The Roosevelt Wild Life Forest Experiment Station, the Memorial to Theodore Roosevelt, is just the sort of memorial which he would have approved. There was ever present in Roosevelt a keen interest in wild life, primarily an interest in the habits and actions of animals, in their family life, and in the way they carried on the struggle for existence. Throughout his life in the hunting field he was an enthusiastic observer of animal behavior, a far keener one than most of our expert naturalists. Nothing would have brought more joy to Roosevelt's heart than the establishment of a Wild Life Experiment Station such as you have, where animals can be studied free from artificial conditions.

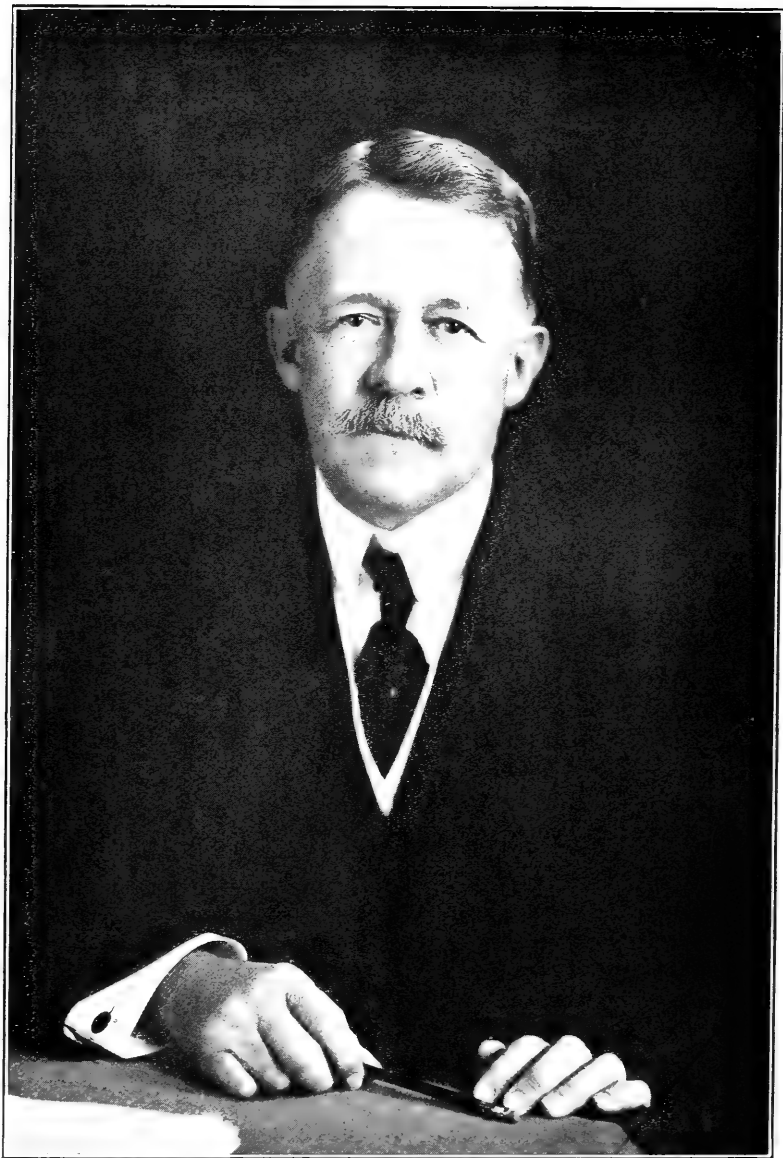
Roosevelt contended for many years that faunal or field natural history studies were fully as important a feature of natural history as closet or laboratory investigations. At the present time nearly all naturalists are of this opinion, but during Roosevelt's youth, when he was a student at college, the field naturalist was considered a very superficial sort of investigator, and this deprecatory attitude kept Roosevelt from taking up faunal natural history as his life work. Today, however, all naturalists are agreed that animals react normally only in their natural or wild environment, and any observations that may be made in the laboratory must be verified in the field before they can be accepted as normal or characteristic of a particular species. Roosevelt emphasized the idea that the real laboratory in which to test theories and study animal behavior is the great out-of-doors, the field, where all life is struggling for existence and exhibiting its characteristics for our observation and study.

Colonel Roosevelt may be said to have introduced the term "faunal naturalist" to the public through his natural history writings. He demonstrated in his African expedition what a marvelous faunal naturalist he was by acquiring a great mass of new observations on the life histories of the animals with which he met. Roosevelt was a practical faunal naturalist who had scant sympathy for mere theories in zoology. As an instance of this may be cited his application of the protective coloration theories of certain modern naturalists to the actual field conditions as he found them in Africa

and America. He discovered that in many cases the authors had placed the animals in an imaginary environment to make their coloration appear protective. When Roosevelt applied the color theories to the actual field conditions he found that the coloration was, in many cases, far from protective, the actual conditions of environment often making it astonishingly advertising. It was a great boon to the study of protective coloration to have a field naturalist of the wide experience of Roosevelt call attention to the numerous errors of application as well as to the defective reasoning in many color theories.

As one of the naturalists of the Roosevelt African Expedition, it was my especial duty to preserve for the Smithsonian Institution the skins and skulls of all the game animals shot by Colonel Roosevelt. I accompanied him daily in the field so as to be near when he bagged the big game. The Colonel was a delightful companion, and on our rides afield we had long talks together regarding game animals and zoology generally. He had at his command the entire published literature concerning the game mammals and birds of the world, a feat of memory that few naturalists possess. I felt constantly while with him that I was in the presence of the foremost field naturalist of our time, as indeed I was. His indelible memory seemed to furnish him with all the known facts about any species of game animal, or any phase of vertebrate zoology, or theories concerning it. Whatever I might say regarding my experiences in collecting animals in foreign lands, or as to my knowledge of animal behavior, Roosevelt always understood every detail, and I was constantly delighted by his remarks and by the keen interest he always exhibited in the animal life about him. His exhaustive knowledge of zoology always gave him the ability to think clearly along scientific lines, and he was never led astray by misinformation or fantastic theories concerning animal life.

The Roosevelt Wild Life Forest Experiment Station will, I sincerely hope, receive the support that will enable it to assume the foremost rank among institutions devoted to the study of wild life in its natural environment. It bears the name of a man whom we all loved and admired for the whole-hearted way in which he devoted his life to America, that it might be a better place to live in; and to one whose sincerity and Americanism will ever remain a great inspiration to his countrymen. It seems peculiarly fit that this institution should commemorate such a man as Roosevelt, whose keenest enjoyment in life was the pursuit and study of animals in their native haunts.



GEORGE WALBRIDGE PERKINS

1862-1920

Late President of the Commissioners of the Palisades Interstate Park

THE PRESENT ECONOMIC AND SOCIAL CONDITIONS AS RESULTS OF APPLIED SCIENCE AND INVENTION

BY HON. GEORGE W. PERKINS

*Late President of the Commissioners of the Palisades
Interstate Park*

[This paper, by the late Hon. George W. Perkins, President of the Commissioners of the Palisades Interstate Park, was presented before the Section of Social and Economic Science of the American Association for the Advancement of Science, Dr. George F. Kuntz, Chairman, at Pittsburgh, December 29, 1917. At the conclusion of the ensuing discussion, Mr. Perkins presented me with a copy of the manuscript, from which this paper is published.]

This paper has been considered particularly appropriate to publish in this *Bulletin*, because it outlines in a striking manner the precise relation that scientific research and invention bear to practical problems. It has an added interest in coming not from a professional scientific man, but from a leader in large constructive business enterprises. The dependence which he recognizes between research and practice is the same relation that the research of the Roosevelt Wild Life Station should bear to practical wild life problems.

An early number of this *Bulletin* will contain a paper by me entitled "Forestry and the Food Problem," in which it will be shown how intimately research on wild life is related to practical problems, as exemplified by the production of food for man from the non-agricultural or forest lands and waters.

Mr. Perkins was a close personal friend of Mr. Roosevelt, and his active, practical cooperation in the wild life research of the College, and of the Roosevelt Station, has been much appreciated. The first financial support which the Roosevelt Station received from outside sources was through Mr. Perkins' cooperation in the Palisades Interstate Park. His interest was further shown by his suggestions. He said: "As a matter of actual fact I think that any Roosevelt Memorial along the lines you suggest ought in some way to be connected with the Palisades Interstate Park, because, as you doubtless know, Roosevelt started it and was interested in it for many years, and it has come to be a very large undertaking. However, I do not feel like advocating this, because I am President of the Park Commission and have been since it started. However, since you bring up the question of using the Park in connection with the matter in which you are interested, I will say frankly that I think this is where it ought to be located. . . . I am just at the eve of starting out to raise a considerable sum of money for the Park. Would there be any way of our getting together on the undertaking?"

Plans were later presented to him, and were under consideration by him when overtaken by his last illness. To his wife, Evelina B. Perkins, the Station is greatly indebted for permission to publish the address that follows, as well as for the excellent portrait accompanying it.—C. C. A.]

As recently as when our fathers were boys, Samuel F. B. Morse flashed to the world the first message ever carried by electricity. That message was the query, "What hath God wrought?" How

prophetic was that query, in view of the stupendous revolution in social and industrial relations brought about since then by the use of electricity!

When miracles are mentioned our minds instinctively revert to the miracles chronicled in the Bible; and yet, with the possible exception of the raising of the dead, is there a miracle recorded in the Scriptures that is more wonderful than the miracle of the telephone? It is a miracle of a very real, practical nature; a miracle that has revolutionized every detail of our present-day life, social, financial, and industrial; a miracle that has annihilated space and brought the world so close together in its everyday relationships that we have become one small group of people, regardless of the hemisphere on which we live or the race to which we belong.

Business Revolutionized by Science. The revolution in business methods caused by the use of electricity has been so rapid and so complete as to cause bewilderment and consternation in the minds of multitudes of our people. They are fairly staggered by the mighty changes that have taken place, and I sincerely question whether they comprehend the fundamental cause of these mighty changes; and this lack of comprehension, in my judgment, is responsible for much of the unrest that permeates the world today. Multitudes of people engaged in everyday affairs are seeing the results, feeling the results, without understanding the causes, for they have not been furnished by the men who have produced them with sufficient information as to the causes and the results which these causes are bound to produce.

The business men of the United States have been very properly charged with having been so engrossed in money making during the last quarter of a century that they have given very little if any attention to public affairs; have given very little if any of their superb ability to public service; and have given nearly all of their ability to pursuing selfish ends, largely of a money making nature. Much can be said to substantiate this charge, but, in my judgment, a similar charge can be made against the men of science. They have been so engrossed in the fascinating problems on which they have been working that they have taken little or no time to inform the public as to the practical effect that modern scientific inventions were bound to have on the everyday lives of our people. These inventions have been placed in the hands of the people of the world within the last third of a century, and their application to business

and social affairs has overthrown and carried away a countless number of old practices and precedents. The result has been a mighty conflict between the old laws of man and the new laws of science. One or the other has had to give way. As the man-made laws were the outgrowth of centuries of effort and cumulative human knowledge, it did not seem possible that anything could come into the world that would set all this cumulative knowledge and experience to naught, and to do it over night as it were. Such, however, is the actual situation; but a vast majority of the people of the world do not realize this, do not understand it. It is also true that even a large number of our more intelligent men have refused to accept the new conditions in which we live, and have insisted on continuing under the old system, following old precedents and practices. As a result, a mighty conflict has engaged us and will continue to engage us until our people and the other peoples of the world realize that a mighty upheaval has taken place; that we have entered a new world of thought and action, dominated almost wholly by the discoveries of science within the last half century; that new codes of business morals, of finance, of industry are being set up; and that it behooves us all to give the best thought, the broadest vision, and the most unselfish devotion to the erection of a new structure that will be in harmony with the modern economic needs of our people.

Who can be of more help in this great reconstruction period than the scientist? Should he not, in the present troubled and confused thought of the world, give of his thought and time to the work of informing the people in simple, easily understood language as to what he has done to upset our old practices and customs? Should he not tell them wherein his work and accomplishments will be of benefit to the people and why? Should he not show them how impossible it is to follow old precedents and practices when he, the scientist, has by his discoveries and inventions completely wiped out old methods; when he, the scientist, has, through the miracles he has wrought, destroyed old tools and substituted new ones? Until the people as a whole realize this, it is going to be most difficult to readjust our minds sufficiently to make us capable of rearranging our social and industrial practices.

The bitter conflict that has been waged in our country during the last twenty-five years between the old laws of man and the new laws of science has been caused by a lack of understanding on the

part of our people as to what has been going on. I believe that a half century from now — yes, much sooner — our people will look back at the struggle in which we are engaged and marvel at our short-sightedness. They will look upon it then much as we nowadays look upon the witchcraft of early New England days.

Facility of Communication Enlarges Business. For the last twenty-five years the scientist and the inventor have almost daily placed in the hands of the merchant and the manufacturer some new instrument or device that has made it possible for him to speed up his business and reach out and do business at far distant points; some new device that has made it possible for a single human mind to do infinitely more business than any human mind ever did before. As soon as the business men began to employ these devices, our old man-written laws of a quarter or half century ago were invoked to prosecute these men who, as a matter of fact, were simply using, in their practical everyday work, the discoveries of science and the instruments of the inventor.

How perfectly absurd it is to allow a man to invent a machine, to applaud and honor him for such invention, and the very next instant attempt to place behind the bars the business man that uses that invention. This is precisely what our country has been doing for a quarter of a century. The telegraph that Mr. Morse invented and the telephone that Mr. Bell invented have been acclaimed as the great discoveries of the age, and these men have been hailed everywhere as great benefactors of the human race; yet had it not been for these two inventions how utterly impossible it would have been to have had an interstate corporation or a so-called trust. Our politicians have told us that the tariff made the trusts. They seem to have forgotten that while we have had a tariff in this country for more than a hundred years, we have only had large interstate corporations for a matter of thirty or forty years. Intercommunication, improved and developed through the use of electricity, has been the underlying cause of the great industrial interstate and international enterprises. Raise or lower the tariff as much as you please, and leave modern intercommunication undisturbed, and your great interstate and international industrial unit of today would continue; but take away the strange force which we call electricity, and your interstate and international business concern would fall to pieces in short order. The telephone, not the tariff, made the trusts.

Intercommunication is the first requisite for doing business. In our grandfathers' day there was no concern larger than that of the store owned and operated by one individual, for the simple reason that an ox or horse team could not go very far, and they were the only methods of intercommunication. Intercommunication has rapidly improved, thanks to the marvelous work of the scientists and inventors, and as it has improved and extended business has grown from the individual to the firm, from the firm to the company, from the company to the great international corporation. The only way to stop this development, to set it back where it was in our grandfathers' day, is to eradicate the causes that have produced the results. My plea is, that our people be told all this in plain, everyday language; that they be told it by you, the men who are so largely responsible for creating the cause that has produced the result.

Until our people understand the fundamental cause, we are going to have a conflict of titanic proportions. A campaign of education is therefore imperative, for much that we learned in our youth must be consigned to the scrap-heap, discarded altogether. We must learn new methods of thought and of action. In order to do this our people must have the facts. We cannot expect them to readjust their thought and their action to such a great extent as they must without facts that are indisputable. Who can give them these facts better than the men who have created them, the scientist and the inventor?

Cooperation the Path of Power. Steam and electricity have been the great unifying forces in business. With their advent it becomes perfectly natural for men to reach out and command larger areas of trade, to have great, practical visions of interstate and international conquest in trade. The people as a mass do not understand this. They almost feel that supermen have come into the world in the last quarter of a century — men of far greater mental ability than ever existed before. This of course is not true. The men of the last quarter of a century have accomplished what they have, not because they were endowed by the Almighty with vastly better mental machines than their fathers possessed, but because they have been endowed by the scientist and the inventor with vastly better material machines than their forefathers possessed. If our grandfathers wished to talk with a man in the next block, they had to put on their hats and go and hunt up the man. If a man living

in Boston wished to talk to a man living in San Francisco, he had to transport his body across the continent before he could do it. Today, all that is necessary is for you to turn in your chair, pick up a tiny instrument, and command the voice of your friend whose body is on the other side of the continent, and his voice immediately sounds in your ear.

The Germans were the first people who had sufficient vision and courage to comprehend what mighty and practical changes the scientist and the inventor had wrought in business methods. They lost no time, twenty-five years ago, in shaping their future to be in keeping with the great new electrical age which the world was entering. They formed large trading companies, with great rapidity abandoned the old axiom "competition is the life of trade," and substituted the new slogan "cooperation is the life of trade." With this slogan they went out for the trade of the world. At the same moment our country took exactly the opposite course, and through the passage of the Sherman law declared that competition was and must continue to be the life of trade.

Japan is another country that has lost no time in throwing off the customs and precedents of the past and entering the great new electrical world with broad vision and splendid courage. Witness what Japan has accomplished in less than half a century. She has cast off the customs and precedents of centuries, and has reached out with great eagerness for the newer and more advanced thought of the world. She has sent her best young manhood to the universities of all the civilized countries. She has sent commissions of her most able men to all points of the globe, that they might bring back the best thought and most advanced practices in social and business relations. For the last quarter of a century precedent has meant nothing to Japan. She has thought only of the matchless opportunities that are opening to the world because of universal education and vastly improved methods of intercommunication.

In both Germany and Japan the government has worked hand in glove with its merchants and manufacturers, leaving no stone unturned to make it clear to their people that the customs of their fathers and forefathers were things of the past, and that new beliefs, methods, and practices must take the place of old ones.

Foreign Business Methods Ahead of American. We pride ourselves on being a new country, a progressive country, free from the shackling influence of precedent. As compared to Germany

and Japan, in their accomplishments of the last quarter of a century, we are an old, benighted country. While both Germany and Japan have been reaching out into the future with new methods and practices, our so-called statesmen and laws have tried to bind us hand and foot to an archaic past.

Fifteen years ago some of our business leaders with vision and courage attempted to organize the railroads of our great Northwest into one company, and planned to connect that railroad system on the Pacific coast with a line of steamships to Japan and China. Under an archaic law our Government attacked the enterprise, declared it illegal, and prevented its being carried out. The project was abandoned, and the ships for the Pacific were never built. Later on, the La Follette law was passed, which effectually disposed of the few ships we had remaining on the Pacific Ocean; and today, in place of our being a potential factor in the carrying trade of the Pacific, we are a negligible quantity, while Japan, which many of our people still regard as an ancient nation, has forged ahead and practically taken possession of the carrying trade of the Pacific. All this is largely due to an utter lack of understanding on the part of our so-called statesmen, and our people as a whole, to the great economic changes that have been brought into the world, not so much through the selfish desires of business men as through the potential achievements of science.

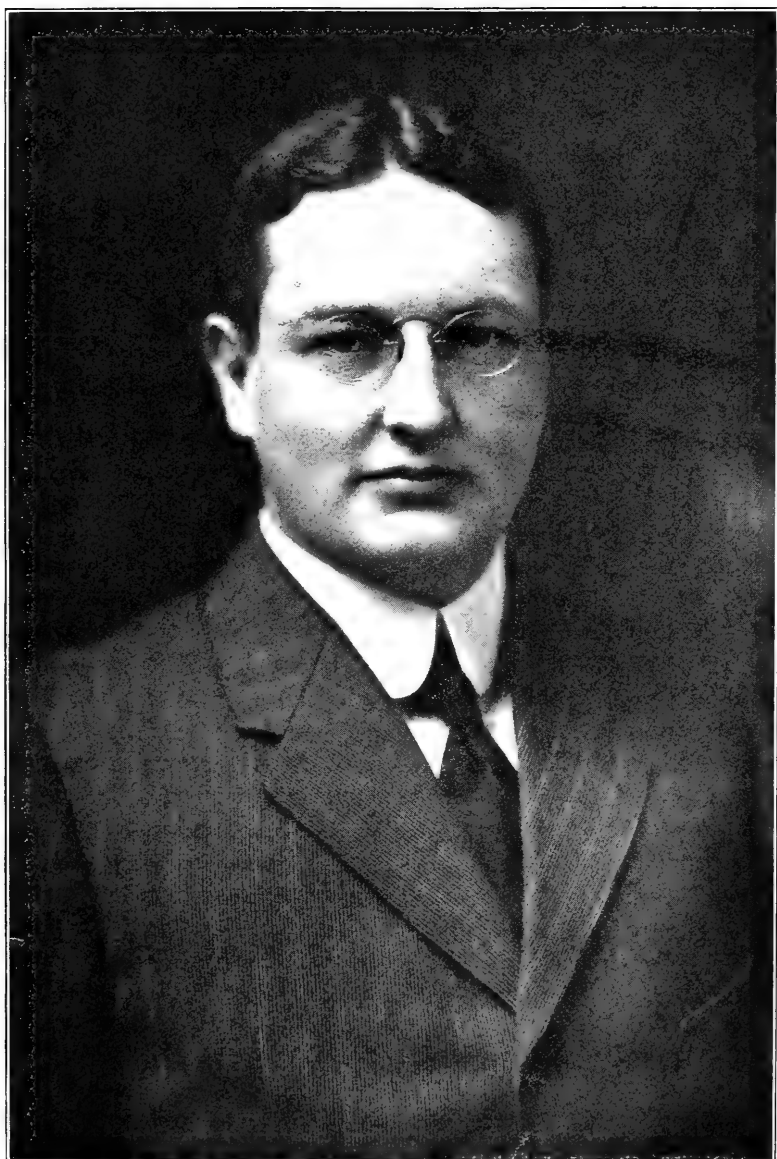
The modern commercial accomplishments of Germany are too numerous to mention, but the latest one of which I know is the creation in Berlin of what is known as a Federal Purchasing Bureau. I understand that hereafter, when a merchant in Germany wishes to procure some commodity that is to be procured outside of Germany, he will be required to go to this purchasing bureau of the Government and lodge his order. Take copper for instance: If the German copper merchants wish to buy copper, they will each go to the Government purchasing bureau and lodge their respective orders for, say, May copper. When the orders are all in, this purchasing bureau will go into the world to buy, say, fifty million pounds of copper. It will naturally come here, for we produce such large amounts of that metal. When it comes here it will find that our laws require that our copper merchants compete with one another in the sale of copper, while the German law requires that their merchants cooperate with one another in the purchase of copper. The method of Germany is, therefore, exactly

the opposite of our method. Which is right? If Germany is right, then she is acquiring from us one of our most precious metals on terms very advantageous to her and very disadvantageous to us.

Duty of Science Toward the Public. Twenty-five or thirty-five years ago, before science and invention had perfected electrical intercommunication, such arrangements as these did not and could not exist. But today they can and do. Not only this, but in the judgment of all thoughtful men they are but in their infancy, for science and invention are making stupendous strides in perfecting instantaneous intercommunication of thought and the more rapid transportation of our bodies and commodities from point to point. When this war shall have finished, the conquest of the air will have been accomplished. The wireless will be a practical, everyday instrument. The submarine telephone will doubtless be in operation, and international lines will then mean about as little as state lines mean now, all because of what science has accomplished.

Surely, you men of science have vast accomplishments to your credit. You have reason to be exceedingly proud of a great record of achievement; but is it not high time that you "did your bit" by making it plainer to the people as a whole what your accomplishments mean to them in their work-day lives, making them understand that while you have destroyed an old order of things you have created a new and better order of things. Would it not be highly beneficial to our country if some of your meetings and discussions were given over almost wholly to the task of enlightening the people as to why it is that old methods must be discarded for new methods? Will you not give your splendid talents to plain talks with the multitude, for a great crisis confronts the world?

It is the crisis of changing in a night, as it were, from the age of the ox team to the age of the flying machine. Certainly no such stupendous revolution has confronted the world in all its history, and unless our people can comprehend it all, can understand it all, they will not be qualified to deal with it in their homes, in their business, and above all, at the polls where representatives are selected by them to make new laws and discard old ones.



CHAUNCEY J. HAMLIN
Member of Honorary Advisory Council

SUGGESTIONS FOR THE MANAGEMENT OF FOREST WILD LIFE IN THE ALLEGANY STATE PARK, NEW YORK

BY DR. CHARLES C. ADAMS, DIRECTOR

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Introduction

The establishment of preserves for wild life and the purposes of natural history has made much progress in America during the past quarter of a century. At present there is urgent need of greatly increasing their number, and an equally acute need of scientific study of the best methods of managing them; and of teaching the public how most thoroughly to understand and benefit by them. Reservations cannot be simply established and then left to themselves, because by normal increase their wild life may soon become a menace to itself and may even defeat the purpose for which the preserves are established. Wild life must today be intelligently supervised; and it is quite a difficult applied science to maintain it in a normal wild state in this modern world. Those wonderful Louisiana preserves, now that they are created, must be carefully studied scientifically or they will not, in the long run, be a success. We hear much more about setting apart reservations than we do of their proper care and use; the first step of course is to establish them, and then comes the problem of their utilization. The Roosevelt Wild Life Forest Experiment Station was established primarily to investigate just such problems, and since its beginning has devoted itself to such investigations.

The Roosevelt Wild Life Station has reason to take a special interest in the Allegany State Park because of its part in the move-

ment that led to its establishment. On March 5, 1920, Mr. J. C. Brennan, President of the Erie County Society for the Protection of Fish, Birds and Game, sought the assistance of the Roosevelt Station for a fish survey of Erie County, because the Station had previously conducted fish surveys in the State. Mr. Brennan was assured of the hearty cooperation of the Station and the services of its specialist on fish, Professor T. L. Hankinson. He also conferred with Mr. Chauncey J. Hamlin, President of the Buffalo Society of Natural Sciences, who had already secured the cooperation of the Erie County Society. President Hamlin came to Syracuse to consult about these plans, and while in conference with Professor Henry R. Francis, of the Department of Forest Recreation in the College of Forestry, and myself, both of whom had previously had experience in the Palisades Interstate Park on the Hudson River, it was suggested that there ought to be established in Western New York a large public forest which should embrace every phase of modern park activity, including fishing, hunting and camping. For years sportsmen and conservationists in Western New York had been talking about the need of a wild life preserve there, but nothing had taken definite shape. Following this conference, Mr. Hamlin, working with Mr. Hamilton Ward, Mr. Brennan and Mr. James Savage, interested a group of public-spirited citizens, including ex-Senator A. T. Fancher of Salamanca, and several gentlemen from Chautauqua County, including Mr. F. G. Kaiser, and an active organization was soon under way. Dean F. F. Moon had given assurance of full cooperation on the part of the College of Forestry. Later President Hamlin visited the Palisades Interstate Park, and with the assistance of Mr. Edward F. Brown, formerly Superintendent, Camp Department of the Palisades Park, organized local committees in New York City and in Albany designed to promote these plans.

In behalf of the committee, Mr. Brown visited Cattaraugus County and prepared a report suggesting plans and legislation for the proposed park. A brief of this report was published in 1920 under the title, "A State Park for Western New York." At Mr. Brown's request I prepared a tentative plan for the wild life and the natural history resources of the proposed park. This was incorporated in his unpublished report and brief mention of it was made in the published abstract. Through the activity of the Buffalo committee, Mr. Hamilton Ward and Senator Henry W. Hill, there was drafted a bill authorizing the establishment of the

Allegany State Park, and it became a law in May, 1921, with the signature of Governor Nathan A. Miller.

The Roosevelt Station has thus, from the inception of the plans which resulted in the establishment of the Park, been actively interested in its progress. As but few working plans for wild life parks have been published, and as new parks are continually being established throughout the country, the publication of these suggestions is intended to assist the men and women promoting them. It should be understood that these plans were formulated to meet a specific case, and yet their application is widespread. At the end of this paper I give a copy of the law under which the Allegany Park is established and to be conducted (see pp. 75-81); and references to publications that will be of special value to those interested in this phase of wild life work.

It should be borne in mind that throughout the plans for this Park it is intended to practice modern reforestation of the much cut-over land, and establish there a forest so managed as to produce a permanent yield of timber, except in the area reserved for the Natural History Sanctuary and in the suggested experimental "Roosevelt Field Station." Its system of management is intended to harmonize with the fullest and best public use of this large forest area. The plan will provide not only for the permanent supply of timber needed for construction of buildings, for camp-fires, and other purposes, and will shelter many kinds of plants and animals native in such a forest, but it will also provide the beautiful natural appearing woodland background desired for a camping park. In time, such a forest will become an important source of revenue for maintenance of the Park, and it should be made an example showing how all uses of the forest can be harmonized when intelligently organized.

The Legislature has authorized the establishment of the Allegany State Park in Cattaraugus County, about seventy miles south of Buffalo, near the State line, in the great bend of the Allegheny River as it swings up into New York from Pennsylvania in the vicinity of Salamanca. This is a part of the Appalachian plateau, lying at a level of about two thousand feet above the sea, while entrenched in this upland lies the beautiful open valley of the Allegheny River, flowing about a thousand feet below. Many of the tributary streams, such as Quaker and Wolf Runs, are fine trout brooks. The whole region was once densely forested, but has been cut over repeatedly. An occasional bear or deer is now



Fig. 1. Allegany State Park, looking up Quaker Run from Hotchkiss Hill, showing general character of the topography.



Fig. 2. Mature forest in the "Big Basin," near the head of Stoddard Creek, Allegany State Park.



Fig. 1. View of Quaker Run, Allegheny State Park.



Fig. 2. A bayou in Tunungwant Valley, Allegheny State Park.

found there, and hares, cotton-tail rabbits, grouse and woodcock still abound. The region is thus already well stocked, and intelligent fire protection and supervision will make the Park an excellent refuge for every sort of wild creature native to that part of the State.

Angling and Hunting Preserves

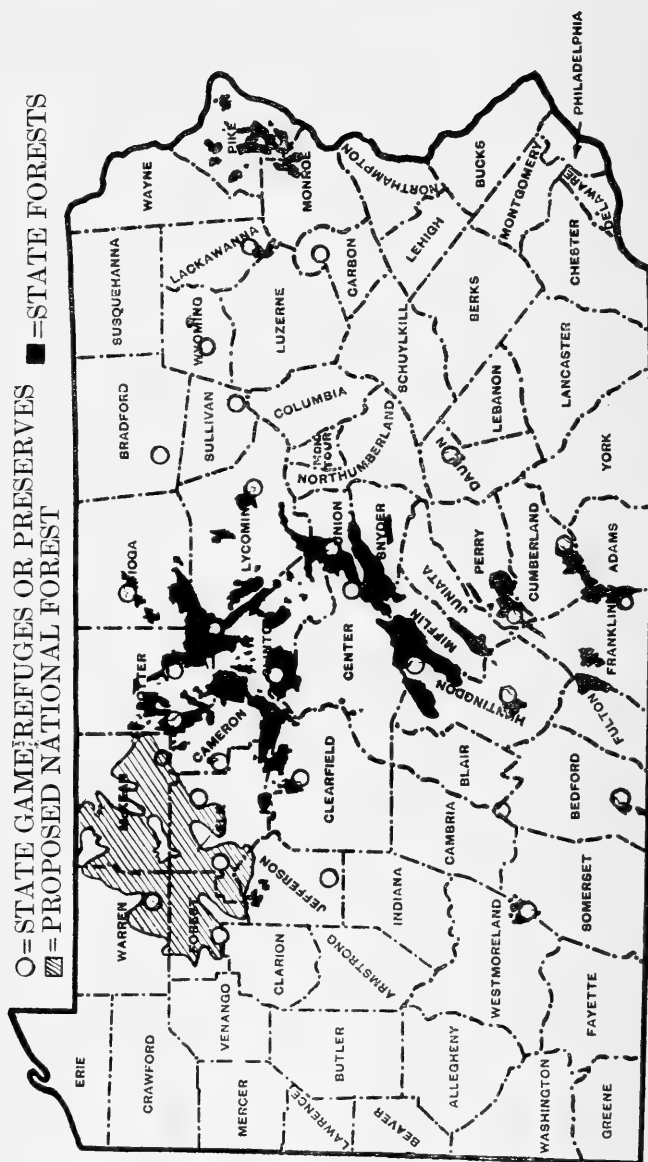
A large public angling and hunting preserve is needed in Western New York, where deer, bear, grouse, wild turkey, woodcock, hares and rabbits, as well as trout and other fish and game, can thrive in abundance, so that the people may have an opportunity for healthful outdoor recreation near at hand. That such a preserve should abound in fish and game can only be assured where there is a large area, carefully stocked, protected and supervised in a thoroughly modern fashion. Park wardens, wild life keepers, and park police can assure reasonable protection; and under the management of competent fish and game keepers, large breeding sanctuaries (where no killing will be permitted) can be permanently maintained, affording excellent sport year after year for a large number of persons.

Under the Pennsylvania system of game preserves, according to John M. Phillips ('20), one of the Pennsylvania Game Commissioners, a central area bounded by a single-wired fence waist high, marks the sanctuary within which no killing of game is allowed, while the surrounding area is a public hunting ground during the regular open season. Under this system game has greatly increased in numbers in Pennsylvania. The location of these preserves is shown on the map of Pennsylvania, p. 68.

It has been found advantageous to make these preserves of about three thousand acres, and not to exceed ten miles in their longest diameter. They are situated in the midst of a forested area. Game vermin on these tracts is killed off persistently, and thorough fire protection is given. A keeper's duties not only include protection, but also the planting of fruits, nuts, berries and other vegetation to provide food and shelter for the birds and other animals. The preserves are fully posted and are protected by fire lines. Whenever possible, in the Allegany Park, fish and game should be given equal protection, and in some cases it may be necessary to establish special fish preserves, independent of the game sanctuary, in order to protect certain valuable breeding grounds. (See also Scudder, '17).

LEGEND

- O = STATE GAME REFUGES OR PRESERVES
- ▨ = PROPOSED NATIONAL FOREST
- = STATE FORESTS



Map showing the location of the Pennsylvania State Game Refuges and Preserves, in relation to the State Forests and the proposed National Forest.

There are today about thirty State game preserves in Pennsylvania, including one in Tioga and three in Potter County, these counties being on the New York State line. There are none in Erie, Warren or McKean Counties, which are also adjacent to the State line and the Allegany State Park. To equip one of these preserves costs about \$2,000, and its maintenance requires about \$1,200. The system has completely restored good hunting in Pennsylvania, and would, with intensive care made possible by wardens, keepers, and police, properly justify a moderate fee for the enjoyment of these privileges. By such means a fund could be accumulated to pay at least in part, for the wild life maintenance.

In the present Park there should be several of these preserves, particularly in the remote areas, because other park visitors must be fully protected from accidental shooting by hunters, or the fear of stray bullets. If tramping trails are laid out in the hunting preserve, they should therefore be closed during the hunting season. Shelters and camps should be provided for sportsmen in the hunting areas.

The preserve method for maintaining game in the Allegany Park should be carefully adapted and applied to angling preserves. (See Kendall, '18; Adams, Hankinson and Kendall, '19). This may involve a system of rotation, by periodically opening and closing certain areas, in order to keep the waters fully stocked. All game preserves should occupy the most remote and inaccessible parts of the Park if they are to be developed to the highest degree, as by this means the greatest acreage can be secured, with the least disturbance of the game by the visitors and with the least risk to human life by accidental shooting. The hunting season of course follows the summer season with its maximum number of Park visitors, but there should be absolute safety from hunters throughout the year.

A Natural History Preserve

In addition to the angling and hunting preserves just discussed, a large area of the Park should be set aside for a Natural History Preserve where no hunting or angling should be allowed, and where plants and animals should be carefully protected in as nearly a natural state as is possible (Adams, '13). This area should be devoted mainly to the scientific, educational and recreational interests that cluster about natural history in all of its varied phases, as expressed in the popular regard for flowers, trees, birds, rocks, minerals and fossils. Tramping and boating should be encouraged and their needs amply provided for. (See Buxton, '84, preface;

Conwentz, '09). This area might be divided into two sections, the first constituting a wild life exhibit.

a. A Wild Life Exhibit. Here would be assembled animals both formerly and now native to the region, and this animal collection should be made easily accessible to the public. There should be represented the buffalo, bear, deer, beaver, elk, wildcat, wolf, wild turkey, grouse, squirrels and many others, all in suitable quarters, so that those with limited time in the Park might easily become acquainted with the native animals of the region. The recreational and educational value of this, so limited, would be very great, and it would be a very attractive feature of perennial interest to automobile visitors as well as to campers. (See Smith, '14).

A second section of this preserve should form a natural history sanctuary.

b. A Natural History Sanctuary. To those who are camping in the Park, or who wish to make extended walking trips through it, as well as to amateur naturalists and to pupils and students of our schools of all kinds, the Natural History Sanctuary should be particularly attractive (Adams, '10, '21). In this area there should be preserved the best remaining fragments of the *virgin forest vegetation*, and these should be very carefully protected, not only from fire but also from all other harmful influences. Even the picking of flowers to excess, or the collecting of animals, should be restricted. There is, however, as much reason for allowing boys and girls, and pupils and students, to pick flowers and to collect natural history specimens for either pleasure or study, as there is for allowing others to catch and kill fish and game, or to wear out the grass in our city parks. There is, of course, equal justification for spending money to maintain a natural history preserve as for spending money to stock the woods and waters with fish and game. We have only been slower in recognizing the educational, recreational, and scientific value of this aspect of natural history. The park authorities should fully recognize this need, and carefully encourage and wisely guide it, so as to secure a proper use and appreciation of all natural history objects to the best advantage. Special permits should be given to collect natural history specimens; or this might even be done without a permit when accompanied by an official Nature Guide or authorized leader.

The Natural History Sanctuary should be as diversified physically as is possible in order to include the greatest variety of animals and plants, and their various associations. In this area there should

be preserved the best samples of virgin forest and other natural vegetation in the region, and any specially valuable or interesting geological exposures or physiographic features. A systematic effort should be made to *restore in this area as near virgin conditions as possible*, so that in a generation from now a good sample of almost primeval forest, with its native plants and animals, would be available to the public, not only as a memorial or monument, but also for educational, scientific and recreational purposes. (See Conwentz, '09; Adams, '13; Sumner, '20). Special precautions should be taken to make fire protection for this area as near perfect as is humanly possible. Such a sanctuary should not be fenced unless fencing is unavoidable, but should be carefully guarded by a high grade of specially trained protectors or Nature Guides who would not only guard but also help to maintain the preserve as natural as possible, and who would be able to assist in teaching the public a proper appreciation of natural history. The Nature Guides for this sanctuary should keep thoroughly posted as to the conditions on the area, and should see that the sanctuary is not injured by the visitors. This would necessitate not only guarding especially valuable, interesting or rare objects, but also insuring the proper rotation of use by the public, so that the trails and special features may be allowed time to recuperate after severe use. A large area within this sanctuary should be made an *absolutely wild preserve* of virgin conditions. If necessary, special areas should be purchased for this purpose.

A small museum (see Smith, '14) and a nature library (Graves, '19) should form a part of the equipment of this sanctuary, and there should be provided also special camping sites, shelters and automobile parking facilities. The museum and library would be particularly valuable to campers, to visiting groups of school children, and to those specially interested in one or another branch of natural history.

This sanctuary should have a carefully worked out system of marked trails, so that city people not familiar with the woods would have no hesitation in penetrating the forest solitudes (Adams, '10, '21). A good series of pocket maps ought to be made available.

The sanctuary might not be fenced but might be marked by two strands of wire, and would materially assist, by its overflow, in stocking all other parts of the Park with wild life,—even the angling and hunting preserves.

A "Roosevelt Field Station" for the Roosevelt Wild Life Forest Experiment Station

Adjacent to the sanctuary there should be located on a large, carefully chosen tract, a "Roosevelt Field Station" or field laboratory for the Roosevelt Wild Life Forest Experiment Station. The Wild Life Station was authorized by the Legislature as a Memorial to Theodore Roosevelt because of his great interest in wild life, and is devoted to the investigation of the life histories, habits, and methods of management of forest animals of all kinds. Just such forest management and utilization problems as have been alluded to — and they will constantly arise in connection with the administration of the Angling and Hunting Preserves and the Natural History Sanctuary, as well as in all other parts of the proposed Allegany Park — will require attention. The College of Forestry already possesses, near Red House, in the proposed park area, about one thousand acres of forest land, and is thus already deeply interested in this region. There are a large number of scientific and technical problems in connection with increasing and protecting fish and game in the Park, and in the management of the Natural History Sanctuary, which will require special study. The Roosevelt Wild Life Station, since its establishment in May, 1919, has been working on allied wild life problems in the Palisades Interstate Park along the Hudson River, and elsewhere in the State. With its technical staff it is particularly well fitted to aid and cooperate in the present undertaking. The members of the Station staff have been engaged in similar work for many years. In the Palisades Interstate Park the Roosevelt Station has, for example, made investigations on the fish, birds, methods of controlling the "water bloom" in bathing lakes, mosquito control by fish, and the use of woodland trails in the study of the natural history of forest life. Similar problems arise in all large parks and become increasingly complicated with intensive use.

To conduct properly some of these studies on wild life, the "Roosevelt Field Station" should be fenced, in order to insure *undisturbed investigations and experiments*. For this reason also, it would be best to have this Field Station somewhat removed from the main centers where campers and visitors gather, as well as at a safe distance from the Hunting Preserve.

Upon a comprehensive plan of this character the wild life and natural history interests of the Allegany State Park would be per-

petuated and improved, and the means for attacking many problems that require technical and scientific skill for their solution would be immediately available to the Park authorities.

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Law Establishing the Allegany State Park

AN ACT to provide for the location, creation and management of the Allegany State Park in Cattaraugus county and for the purchase of lands; and making an appropriation therefor.

Became a law May 2, 1921, with the approval of the Governor. Passed, three-fifths being present.

The People of the State of New York, represented in Senate and Assembly, do enact as follows:

Section 1. The Allegany State Park is hereby located and created within the county of Cattaraugus, state of New York, and shall include the lands owned or hereafter acquired by the state of New York within the following described boundaries, to wit: Commencing at a point in the town of Carrollton, where the western boundary of the right of way of the Erie Railroad Company intersects the state line between the states of New York and Pennsylvania; running thence northerly along said western boundary of said right of way to the southern boundary of the Allegany Indian reservation; thence along the said boundary of said reservation through the towns of Carrollton, Great Valley, Salamanca, Red House, Cold Spring, Elko and South Valley, to the intersection of said boundary of said reservation with the said state line; thence easterly along said state line to the place of beginning, excepting and reserving therefrom any part of the city of Salamanca, and any part of the village of Limestone included in the land above described. All of the lands hereinbefore described, and hereafter acquired by the state for such state park shall be forever reserved and maintained for the use of all the people, but the said Allegany State Park shall not constitute a part of the forest preserve.

§ 2. Within thirty days after the going into effect of this act there shall be appointed by the governor of this state, by and with the consent of the senate, five commissioners, who shall be citizens and residents of the state of New York, and who shall constitute, and are hereby appointed and constituted a board of commissioners by the name and style of "commissioners of Allegany State Park." Such commissioners shall serve terms of from one to five years respectively, and the governor shall designate the terms of each of said first appointed commissioners who shall hold office for the terms of their respective appointments, and until others are appointed in their places, and all such commissioners after the first appointment shall be appointed by the governor by and with the consent of the senate and shall hold office for the full term of five years and until others have been appointed in their places. Vacancies in the commission caused by death, removal, resignation, refusal or inability to act, or removal from the state shall be filled by the governor by appointment for the unexpired term only. No member of said board shall receive any compensation for his services

as commissioner, but each commissioner shall be entitled to receive his actual disbursements and expenses in performing the duties of his office. The governor may remove a member of such commission for inefficiency, neglect of duty or misconduct in office, giving him a copy of the charges against him and an opportunity of being publicly heard in person or by counsel in his own defense upon not less than ten days' notice. If such member shall be removed the governor shall file in the office of the secretary of state a complete statement of all charges made against such member and his findings thereon, together with a complete record of the proceedings.

§ 3. In case the state of Pennsylvania proceeds to acquire lands adjoining the boundaries of the said state park to be used for a similar purpose the commission is authorized to co-operate with the said state of Pennsylvania and such representatives as said state may designate for that purpose for the joint control and operation of the Allegany State Park and the adjoining lands in the state of Pennsylvania.

§ 4. Such commissioners and their successors are authorized to sue and bring proceedings in the name of the people of the state of New York, to use a common seal, and make and adopt by-laws to regulate its proceedings. They shall keep a record of their proceedings and make an annual report to the legislature. Such commissioners shall annually choose from among their members a chairman and secretary, and appoint such other officers and such other employees as the commission deems necessary to carry out the purposes of this act. All patrolmen and game wardens appointed by the commission may be uniformed and shall have within the limits of the property of the Allegany State Park, all the powers, duties and liabilities of constables of towns in the execution of criminal process. The board of commissioners may also determine the duties and compensation of such employees and may appoint and remove them at pleasure and make all reasonable rules and regulations respecting the same. The board of commissioners may also build necessary roads and bridges within the boundaries of the said park, erect camps, and may provide and operate such other facilities for the use and enjoyment of such park by the public and for increasing the accessibility of the park to such public, as the board may determine necessary or expedient and the said board may also provide at its discretion by a proper rule or regulation for the terms upon which and the manner in which all such facilities may be used, and may do and perform all things necessary for the execution of the purposes of this act, and have general supervision and control over said park. Such board shall have and maintain a suitable office where its maps, plans, documents, records and acts shall be kept subject to public inspection at such times and under such reasonable regulations as the board shall determine.

§ 5. Within sixty days after this act takes effect, such commissioners shall convene and organize, as hereinbefore provided,

and adopt a common seal. A majority of such commission shall constitute a quorum for the transaction of business.

§ 6. The board of commissioners shall have power to, and shall as soon as may be, after its organization, proceed to select, locate and acquire lands in the name of the people of the state of New York, within the foregoing described boundaries, and shall so far as their appropriation permits, proceed to make the same available for use as a public park and to provide for the protection and propagation of fish and game thereon and for the reforestation of the same.

§ 7. The commission shall, with the approval of the governor, have the power and authority to appropriate real and personal property, in the manner and under the conditions herein defined:

1. Purposes. The commission may enter upon and take possession of any lands or waters or both, or of any forests and rights in timber upon any lands included now, or hereafter to be included, within the Allegany State Park, the appropriation of which, in the judgment of said commission, shall be necessary for public park purposes, or for the purpose of the propagation, protection and conservation of fish and game.

2. Description of land. An accurate description of such property so entered upon and appropriated shall be made by the commission, who shall certify under its seal that the description is correct, and shall endorse thereon a notice that the property described therein is appropriated by the people of the state of New York for the purpose described in this section. The original of such description and certificate shall be filed in the office of the secretary of state. The Allegany State Park commission may make such additional copies of this certificate and description as may be necessary and certify the same.

3. Service of notice. The said commission shall thereupon cause a duplicate of said description and certificate, with notice of the date of filing thereof in the office of said secretary of state, to be served on the owner or owners of the lands, forests, and rights in timber upon such lands and waters so appropriated; and from the time of such service the entry upon and appropriation by the people of the state of the property described in such notice shall be deemed complete, and thereupon such property shall become, and be, the property of the people of the state. Such notice shall be conclusive evidence of an entry and appropriation by the state; but the service of such notice shall raise no presumption that the lands, forests and rights in timber upon such lands described therein are private property.

4. Manner of service. Service of the notice and papers provided for under subdivision three must be personal if the person to be served can be found within the state. If the said commission shall not be able to serve said notice and papers or to cause the same to be served upon the owner or owners personally within

the state, after making an effort so to do which said commission shall deem to be reasonable and proper, service may be made by filing said notice and papers in the office of the county clerk of the county wherein the property so appropriated is situated and by causing such notice and papers to be recorded in the books used for recording deeds in the office of said clerk. On the filing of said notice and papers with said clerk, it shall be the duty of said clerk to record same in the books used for recording deeds in the office of said clerk and to index the name of the person or persons to whom said notice is directed as a grantor in an index book to be kept by said clerk.

In case such service is made by filing said notice and papers in the office of the county clerk, any person so served may at any time thereafter file a claim with the court of claims, against the state, notwithstanding the two year limitation provided by this article or by article one, title three of chapter three of the code of civil procedure, excepting that if the person so served shall be brought in and made a party to any claim or proceeding pending in the court of claims or before a referee having jurisdiction to hear, try or determine a pending claim, such person so brought in and made a party shall not thereafter file a claim against the state on account of such appropriation, in addition to or in substitution for the claim to which he has been made a party, unless he shall file such additional or substituted claim within three months from the time he is so brought in and made a party.

5. Description and certificates to be recorded. If service be personal, the said commission shall thereupon cause a copy of such notice and papers, together with an affidavit of due service thereof on such owner or owners, to be filed and recorded in the same manner as provided in subdivision four, and it shall be the duty of said clerk to record and index same as provided in subdivision four in case service is other than personal; and the record of such notice, and of such proof of personal service, shall be presumptive evidence of due service thereof.

6. Adjustment of claims by agreement. Claims for the value of the property appropriated, and for legal damages caused by any such appropriation, may be adjusted by the commission, if the amount thereof can be agreed upon with the owner or owners thereof. Upon making any such adjustment and agreement the commission shall deliver to the comptroller a certificate stating the amount due to said owner on account of such appropriation of his land or other property, and the amount so fixed shall be paid by the treasurer upon the warrant of the comptroller.

7. Court of claims, jurisdiction of. If the commission and the owner or owners of the property so appropriated fail to agree upon the value of such property, or upon the amount of legal damages resulting from such appropriation, within one year after the service of the notice and papers provided for in section sixty-eight

of this chapter, such owner may, within two years after the service of such notice and papers, present to the court of claims a claim for the value of such land and legal damages; and said court shall have jurisdiction to hear and determine such claim and render judgment thereon. Upon filing in the office of said commission, and in the office of the comptroller, a certified copy of the judgment of the court of claims, and a certificate of the attorney-general that no appeal from such judgment has been, or will be taken, by the state, or if an appeal has been taken, a certified copy of the final judgment of the appellate court affirming in whole or in part the judgment of the court of claims, the comptroller shall issue his warrant for the payment of the amount due the claimant by such judgment, with interest from the date of the judgment until the thirtieth day after the entry of such final judgment, and such amount shall be paid by the treasurer.

8. Court of claims to examine property. The court of claims, if requested by the claimant or the attorney-general, shall examine the real property affected by the claim of damages for the appropriation thereof and take testimony in relation thereto in the county where such property or a part thereof is situated.

9. Oil, gas, mineral and lumber rights may be excepted. The commission may except from the purchase of any lands or waters taken under this article, any oil, gas, lumber or mineral rights thereon, with the right of access thereto, which exception must be stated in the description filed in the office of the secretary of state and in the notice served on the owner, as provided by this section.

Nothing in this section shall prevent the subsequent appropriation by the commission of any rights so excepted.

10. Adjustment of claims for trespass or other injuries. In cases of trespasses or other injuries to lands or property purchased or acquired by the state, the commission may settle and adjust any claims for damages due to the state on account of any such trespasses or other injuries to property or interests of the state, or penalties incurred by reason of such trespasses or otherwise, and the amount of such damages or penalties so adjusted shall be deducted from the original compensation agreed to be paid for the land, or for damages, or from a judgment rendered by the court of claims on account of the appropriation of such land. A judgment recovered by the state for such a trespass or for a penalty shall likewise be deducted from the amount of such compensation or judgment.

11. Judgments. When a judgment for damages is rendered for the appropriation of any lands or waters for the purposes specified in this article, and it appears that there is any lien or incumbrance upon the property so appropriated, the amount of such lien shall be stated in the judgment, and the comptroller may deposit the amount awarded to the claimant in any bank in which moneys belonging to the state may be deposited, to the account of such judgment, to

be paid and distributed to the persons entitled to the same as directed by the judgment.

12. **Costs and disbursements; when offer made.** If an offer is made by said commission for the value of land appropriated, or for damages caused by such appropriation, and such offer is not accepted, and the recovery in the court of claims exceeds the offer, the claimant is entitled to costs and disbursements as in an action in the supreme court, which shall be allowed and taxed by the court of claims and included in its judgment. If in such a case the recovery in the court of claims does not exceed the offer, costs and disbursements to be taxed shall be awarded in favor of the state against the claimant and deducted from the amount awarded to him; or if no amount is awarded, judgment shall be entered in favor of the state against the claimant for such costs and disbursements. If an offer is not accepted, it cannot be given in evidence on the trial.

§ 8. Such commissioners are authorized and empowered, within such park, through their agents and employees, to enforce, in the name of the people of the state of New York, the penalties and conduct the prosecution set forth in the conservation law, and such commission shall have the power to create and establish closed seasons for fish and game within such park as in its judgment may be necessary for the propagation and protection of such game and fish, and may make suitable regulations for the capture, killing and transportation thereof, and such commission shall have power and authority to propagate game and fish for the stocking of the said Allegany State Park, and to make regulations and rules which shall be binding upon all persons within the boundaries of the aforesaid Allegany State Park, whether upon lands owned by the state or otherwise for the purposes of fire, game and fish protection, and to establish and enforce suitable penalties for the violation thereof.

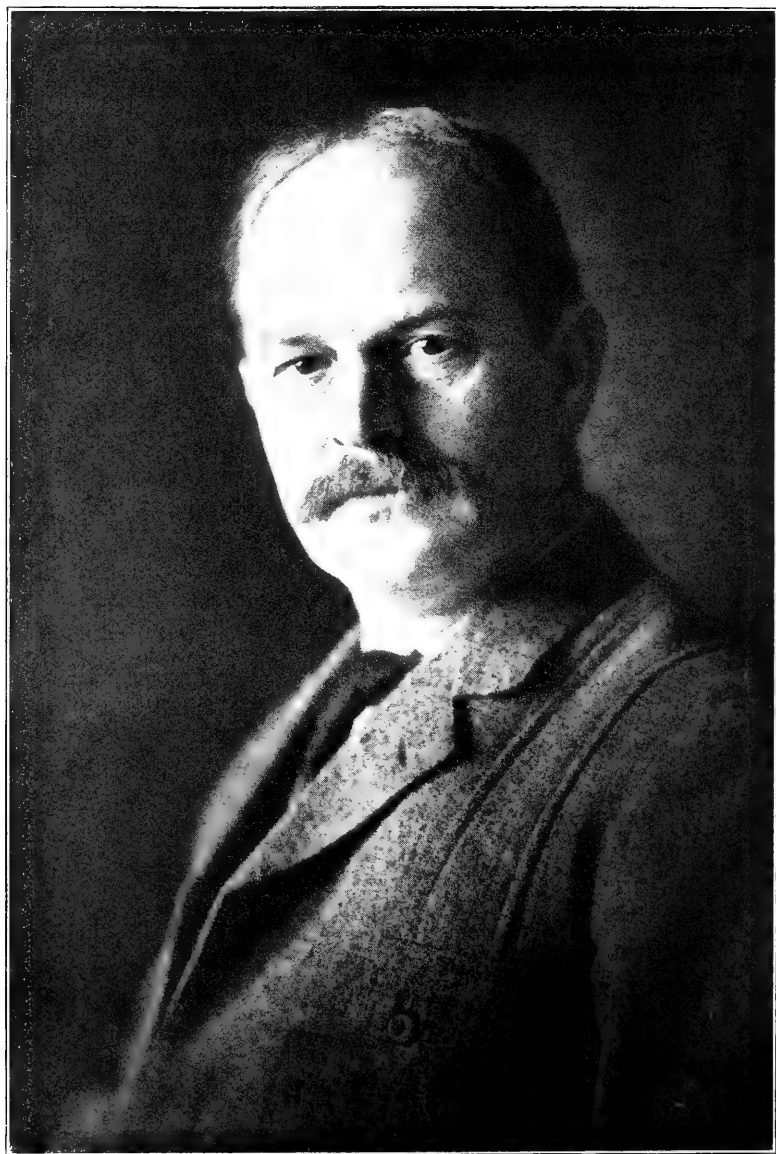
§ 9. Such commissioners shall have the power, in the name of the people of the state of New York, to acquire, maintain and make available for use as a public park, the lands located as aforesaid, and for this purpose shall have the power to take, in the name of the people of the state of New York, in fee or otherwise, by lease, purchase, gift, devise, or through the procedure heretofore set forth, the said lands or any of them, and any rights, interests and easements therein, and to receive by gift, devise or contribution, money to be used in acquiring and improving the said lands or any of them, and the said board shall also have power, in the name of the people of the state of New York, to receive and administer for park purposes, any gift or devise of personal property, or any land or rights in land outside the areas defined in said park, adjoining the same, and it shall be its duty to preserve, care for and lay out and improve the said park, and it shall have power to lay out, construct and maintain roads and pathways over the said park, to

dam the streams therein, except the main stream of the Allegheny river, and to lay out and construct and maintain roads between and connecting any separate portion of said park, and for this purpose to acquire rights of way upon and across any intervening lands, and authority is conferred upon such commission to build and maintain roads across the Allegheny Indian reservation for this purpose, and in case the state of Pennsylvania shall acquire lands for a state park, adjoining the lands herein described, to connect such roads with roads so laid out in the state of Pennsylvania and to maintain such lands within the state of New York so that the same may form a continuous park with the lands acquired by the state of Pennsylvania, and to do all things necessary in their judgment to carry out the purposes of this act.

§ 10. The sum of twenty-five thousand dollars (\$25,000), or so much thereof as may be necessary, payable out of any moneys in the treasury not otherwise appropriated, is hereby appropriated to carry out the provisions of this act. No part of the said sum shall be available for any purpose specified in this act, until the certificate of the commissioners, provided to be appointed herein, has been filed in the office of the state comptroller, showing that the sum of twenty-five thousand dollars (\$25,000) has been donated by individuals or corporations and deposited to the credit of the commission in a bank or trust company to be designated by the commission, to be used for some or all of the purposes specified in this act. Payments from said appropriation shall only be made upon itemized accounts, duly verified, certified and approved by the chairman of the commission, by the state treasurer on the warrant of the comptroller.

§ 11. This act shall take effect immediately.

[Laws of New York, Chapter 468, 1921.]



FRANK M. CHAPMAN

Member of Honorary Advisory Council

AIMS AND STATUS OF PLANT AND ANIMAL PRESERVE WORK IN EUROPE, WITH SPECIAL REFERENCE TO GERMANY, INCLUDING A LIST OF THE MOST IMPORTANT PUB- LICATIONS ON THESE PRESERVES

By DR. THEODOR G. AHRENS

Berlin, Wilmersdorf, Germany

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Introduction: Conservation in Europe

As the aims and status of conservation in Germany constitute the main body of this paper, a few general remarks on the care and protection of nature and natural monuments in other European countries are in order. To obtain protection of natural monuments there are three general ways: by voluntary, by administrative, and by legislative help. In the confines of the former Austrian Empire about 11,000 acres of primeval woods and meadows surrounding Vienna were purchased and reserved. Unfortunately, the recent deplorable economic conditions in Vienna have caused great numbers of trees in these reserves to be cut down for firewood by the inhabitants.

Three hundred and fifty acres in Moravia, with growths of *Juniperus nana* and *Salix herbacea*, and some 285 acres in the Böhmerwald, for the purpose of safeguarding a primitive forest tract in Central Europe, have been set aside and protected. *Picea excelsa* and *Abies pectinata* occur in considerable amounts there. In Belgium the forest of Soignes, near Brussels, and various plant associations of individual interest in different parts of the country have been preserved.

In Great Britain there exists a "National Trust for Places of Historic Interest or Natural Beauty" which was founded in 1895. This association has had deeded to it and holds quite a number of large and small areas of natural beauty in various parts of the country. Under the British Government a number of State Forest Preserves exist, among which the famous New Forest, in Hampshire, and Epping Forest should be mentioned. A noteworthy plant reserve is Burnham Beeches, near Slough, a wooded tract of 315 acres, in which stand beeches ten to twenty feet in circumference, oaks fifteen feet in circumference, and other ancient trees. There are also many bird reserves on the coasts of the United Kingdom, chiefly for sea birds.

In Denmark a number of interesting moors and areas with rare plants and plant associations have been preserved. Birds enjoy also far-reaching care and protection.

In France forest areas with noteworthy trees and plants in several forests, notably Fontainebleau, are protected, and efforts are being made to extend protection of nature in various ways.

In Holland the Naardermeer, in the south of the Zuider See, a breeding place and resort for many rare birds, is preserved.

Sweden has reserved several natural park areas of scenic and botanical interest. In one of them the bears, which are threatened with extinction, are protected. Switzerland guards its rare plants zealously by administrative ordinances, and with the aid of several associations interested, for example, the "Association pour la Protection des Plantes" at Geneva. Switzerland has a beautiful national park in southeastern Engadine, a territory on the Inn, with the wild valleys of Cluozza and Tantermozza and several adjoining districts; and Italy has had the intention to create a national park in continuation of the Swiss Val Cluozza. The area of the Swiss park is about ninety-five square kilometers, and it comprises pine forests and interesting plant and animal associations.

Bird Protection in Germany

An interest in birds and in their protection and preservation has always been maintained in Germany. Various local regulations to protect birds were made from time to time in the eighteenth and beginning of the nineteenth century, but Prof. K. Th. Liebe, who worked for bird preservation in the second half of the past century in Thuringia, in particular, and wrote numerous works about it, may

be looked upon as the originator of scientific and ethical bird protection. The movement increased, and in 1876 a law regarding the protection of useful birds was presented to the Reichstag. This measure failed to pass, but several of the federal states made in the meantime new protective regulations or enforced old ones; and finally in 1884, at the first International Congress of Ornithologists in Vienna, resolutions of importance for the birds came up for discussion. The same may be said of the second International Congress in Budapest, in 1892; and at the third, in Paris, 1902, an agreement was made between Belgium, Germany, France, Greece, Lichtenstein, Luxemburg, Monaco, Austria-Hungary, Portugal, Sweden, Switzerland and Spain, regulating the protection of birds useful for agriculture. This was ratified by the German Reichstag on June 5, 1902. Before this, in March, 1888, a general bird protection measure had passed the Reichstag for Germany alone. This law was revised and passed again in May, 1908, and was a considerable improvement upon that of 1888. Berlepsch, in his elaboration of methods to retain the birds and to facilitate their existence; Conwentz, by the founding of the State Bureau for the Care of Natural Monuments; and countless societies for the promotion of knowledge and protection of birds, advanced the cause of the birds greatly.

The first suggestion for creating Bird Refuges in Germany dates from 1883, but the first actual refuge is the Memmert, a sandbank between Borkum and Juist, in the North Sea, founded in 1907 by the "German Society for the Protection of Bird Life." Gulls and terns are the principal birds breeding there. Two armed guards are stationed on the island, and in 1920 a very satisfactory increase was noted—about 4,000 pairs of *Larus argentatus*, 2,000 *Sterna macrura*, and other species in various quantities.

On the islands of Mellum, Juist, Baltrum, and Langeoog (East Friesian Islands), there are a considerable number of bird refuges. On some, guards are maintained, as on Langeoog; on others, as is the case of Baltrum, the inhabitants guard the birds and their nests to a certain extent. The bird colony of Norderney, however, was destroyed during the war. Competent observers believe that the worst dangers for those interesting and characteristic colonies are past, and that the near future will make up for the losses sustained in the past bad years. At the mouth of the Elbe we find a refuge on the island of Neuwerk, and another on Trischen farther north, where there are colonies of sea birds, notably terns.

On the west coast of Schleswig-Holstein are three refuges; Norderoog, Jordsand, and Ellenbogen, which were founded by the "Jordsand Association" of Hamburg and promoted by the well-known ornithologist Dr. Hennicke, of Gera. All of these refuges have suffered severely from the war and its effects; and Ellenbogen, which has been ceded to Denmark has suffered a total loss of its colony by storms and egg robbery.

In the Baltic Sea the founding of refuges dates from 1909. One of the first is a peninsula known as Priwall, at the mouth of the Trave, in Mecklenburg, and Langenwerder, in the Bay of Wismar, both of which are subsidized by the Mecklenburg government. Langenwerder adjoins the large Island of Poel, where prior to the revolution there were considerable colonies of sea and other birds. Here, as elsewhere, lawlessness in general, and the very widespread lack of food among the poorer classes, have encouraged egg stealing and the consequent destruction of the breeding places.

Perhaps the most interesting of the Baltic bird refuges are the Werder Islands, east of Zingst, Pomerania. They are private property and are cared for by a protective association to guard against egg stealing, as far as possible. A great variety of sea and also land birds breed here, and the place has been considered the most important Baltic refuge. Hiddensee, to the west of Rügen, is another bird colony, of considerable area as compared to the others.

The "Bund für Vogelschutz" maintains some fifty large and small refuges, most of them in Southern Germany, this association having its headquarters in Stuttgart; notably on the Federsee in Württemberg, several islands in the river Neckar, near Lauffen, and others.

The "Deutsch Ornithologische Gesellschaft" started an observatory for noting bird migration in 1900 at Rossiten, on the Kurische Nehrung, the narrow peninsula extending from Samland to Memel, East Prussia. This observatory has since been subsidized by the State, publishes extensive reports, and has solved many interesting problems of migration.

At Burg Seebach, Kreis Langensalza, Thuringia, Hans von Berlepsch, the well-known ornithologist and bird protector, founded and conducts the exemplary Experiment Station for Bird Protection; and we might also mention in the far east the Grosse Lauternsee, in East Prussia, and in the South the Wörthsee, not far from Munich.

In conclusion, it may be said that bird protection enjoys widespread interest and is promoted, as far as possible, among all classes

by means of lectures, literature, etc. At present it has great difficulties to contend with in counteracting the lawlessness and indifference, particularly of the lower classes. The breeding colonies are in great danger because of promiscuous and reckless egg stealing, which is the result of undernourishment among large portions of the people and the great scarcity of eggs at all times and in all places.

Plant and Nature Protection in Germany

Plant protection may be carried out in two ways: either by the reserving and protecting of larger or smaller land areas upon which the plants to be protected are situated, or by the issuing of general regulations for the protection of specified plants in all areas under consideration whereby a special reservation of the land is not absolutely required. There are quite a considerable number of smaller reservations in Germany where plant life is protected and the rare specimens are classified as natural monuments.

A natural monument is now defined as a particularly characteristic formation of nature, especially when *in situ*, and which has remained entirely, or almost entirely, untouched by the progress of cultivation. To these belong areas of natural beauty or specific interest; formations of the earth which are of special interest for the knowledge of the history of the globe or of geology; botanical or zoological formations of interest for their rarity, variety, or other scientific value; certain species of plants and animals, particularly at the frontier lines of demarcation of their geographic or historic distribution; and individual plants prominent for their growth, shape and age. The necessity for protecting plant life, and the beauties of nature connected with it, has not always been sufficiently regarded in Germany, but gradually a widespread interest in preserving rare and threatened plants and landscapes arose; and in 1898, in the Prussian House of Delegates, Wetekamp, a delegate, pointed out the vital importance of definite steps for protection, and thus concentrated the attention of the parliament upon the matter.

Professor Conwentz, at that time Director of the West Prussian Provincial Museum in Danzig, published a memorial pointing out the endangering of primeval forests and demanding small reservations and an inventory of the notable trees and plants in the forests. Conwentz somewhat later published the first forest botanical memorandum for the province of West Prussia, upon request of the Department of Agriculture, and in connection therewith an epoch-

making treatise upon the whole subject of the protection of nature and natural monuments. A Prussian state bureau was then founded in Danzig in 1906, and transferred to Berlin in 1910. A few examples of individual plant dangers and protection are now in order.

Eryngium maritimum (Sea Holly), a plant growing along the coasts of the Baltic, has been torn out in such quantities for floristic uses as to be seriously endangered. Attention having been called to this fact, it has been placed upon the list of plants that should be protected and the plucking forbidden.

Betula nana (Dwarf Birch), a species that is common in Scandinavia, Finland and Russia, is found in only a very few places in Germany and is much endangered by the cultivation of the moors in which it grows. This plant is now protected everywhere, partly by the reservation of the places where it grows, e. g., in Neulinum, near the Drewenzerwald, and partly by protection of individual plants or groups.

Cypripedium calceolus (Venus Slipper), a beautiful orchid.

Trapa natans, a curious water plant, and others.

Ilex aquifolium (Holly), *Taxus baccata* (Yew), *Viscum album* (Mistletoe), are also protected in localities where they are rare or in danger of extermination, e. g., the yew in the Fies Busch, of 45.7 acres.

An interesting plant association is a salt marsh near Artern, Saxony, which was threatened by cultivation but has been preserved together with the typical growths of *Ruppia rostellata*, *Cladium Mariscus*, *Glaux maritima*, and others.

In Brandenburg, near the ruins of the Abbey of Chorin, the Plagefenn and See have been reserved as an absolute sanctuary by the State Forest Administration. This district comprises 417 acres, and consists of forest, moor and lake, constituting a typical Brandenburg landscape, with characteristic plant associations and formations, which has remained untouched by the hand of man since its inauguration in 1907.

A large tract of three to four German square miles, in the Lüneburger Heide, has been acquired by the Stuttgart "Verein Naturschutzpark." This district includes the Wilseder Berg, the highest elevation in the Northwest German plain, and represents a well-preserved and typical moor and heather country.

In the administrative district of Cassel, at Sababurg, the Reinhardswald of about 133 acres of forest, consisting of particularly fine old beeches and oaks, some of the latter having a circumference of

nineteen to twenty-nine feet, has been created a reservation by the State Forest Administration. Seventy-seven acres in the Hasbruch, and 121 acres in the Neuenburger Urwald (in Oldenburg), have been set aside and protected. These wood tracts are types of the very few remaining primeval forests in Germany, and the reservation is to remain untouched. Dead trees will not be removed and trunks are to lie where they fall. Some of the trees are very old and attain considerable dimensions, an oak in Hasbruch having a circumference of twenty-nine feet. In Württemberg, the Wildsee and its surroundings, in the Black Forest, have been acquired and protected in an area of 185 acres. Here the hand of man is also excluded as far as possible.

Moors which formerly covered large areas of land in Germany, notably in the North German plain, have been more and more threatened and endangered by amelioration. As the moors represent the most ancient types of vegetation, are in fact relicts of the ice age, the rare plants growing on them should be preserved as far as possible. Cultivation of all available land cannot be stopped, but the reservation of individual moors in various parts of the country has been recommended and carried out to a considerable extent.

Besides the Plagefenn, already mentioned, Zehlau, a moor of 5,829 acres in the district of Friedland, East Prussia, has been reserved for the purpose of protection. Moose are still found here; but most important is the fact that a primitive vegetation thrives here, and that the indigenous moor mosses are constantly spreading, so that moss growth can be admirably studied and observed, particularly as in most other moors the withdrawal of the moisture by processes of amelioration has caused them to cease spreading, to become dormant. In the Danzig district, 326 acres of moor have been reserved, and in several other sections of Prussia, in Bavaria, and in Württemberg, moors have been set aside and preserved.

Organizations and Administration

The leading organization in Germany is the State Bureau for the Protection of Nature in Prussia. This bureau was founded in 1906 by the Ministry for Education, and was first established in Danzig. In 1910 it was removed to Berlin. Professor Hugo Conwentz, who has been a pioneer in everything pertaining to nature protection in Germany, has been at the head of the bureau since its foundation. Besides its activities in discovery, exploration, and pre-

servation of natural monuments in Prussia, this bureau advises as to and promotes legislation regarding reservations, bird refuges, etc. It is in constant touch with the authorities and with societies interested in these subjects. It also endeavors to raise the funds needed to purchase or to protect landscapes, etc. This bureau is situated in the former Botanical Museum Building, and has a number of spacious, well-lighted rooms for lectures, for the library, and for the use of the staff.

The library contains about 4,500 volumes of all the literature pertaining to nature protection and natural history, a complete collection of maps of all kinds, pictures, photographs and lantern slides. Very valuable is the bibliographical collection, which contains some 15,000 cards, with headings covering the whole field of the care of natural monuments, protection of nature, and kindred matters. It has been the endeavor of the bureau to collect all the foreign literature possible; and information and literature concerning the American National Parks and Monuments are particularly complete. The cards concerned with the most important publications contain an abbreviated synopsis of their contents.

In all parts of the country, that is, in all the Prussian provinces, committees for the care and protection of natural monuments have been established, and these keep in intimate touch with the central office. In all, there are 41 such committees in Prussia. They are presided over by some higher official, but the actual work is in the hands of an experienced and educated naturalist. These committees send out questionnaires concerning natural monuments in their territory, keep in touch with public opinion, provide public lectures and information, raise funds, issue publications, etc. The State Bureau holds weekly conferences where the whole field of interest is discussed, and since 1908 annual conferences lasting from one to two days have been held, in which delegates from the whole of Germany and even from foreign countries have been present.

The State Bureau also issues important publications, among which are *Beiträge zur Naturdenkmalpflege* herausgegeben von H. Conwentz, vols. I-VII (Gebrüder Bornträger, Berlin); *Naturdenkmäler, Vorträge und Aufsätze*, Nos. 1-22 (Gebrüder Bornträger, Berlin); being popular discussions of various themes of nature protection intended to awaken general interest and understanding for the aims of nature protection; and also a very good English work, *The Care of Natural Monuments with Special Refer-*

ence to Great Britain and Germany, by H. Conwentz, Prussian State Commissioner for the Care of Natural Monuments (Cambridge University Press, 1909).

As regards the organizations in the non-Prussian German States, Bavaria possesses a "Landesausschuss für Naturdenkmalpflege" (National Committee for the Care of Natural Monuments), under the collaboration of the Ministry, and connected with it are local committees in different parts of the country.

Saxony has a "Landesverein Sächsischer Heimatschutz" (National Association for the Protection of Saxon Landscapes), with a section for "Naturschutz," and also aided by the Ministry.

Württemberg has a "Landesausschuss für Naturund Heimatschutz," and Baden a "Landesverein für Naturkunde und Naturschutz," each under the Minister of Education; and besides these there are various private associations, such as the very energetic "Verein Naturschutzpark" of Stuttgart. It must be remembered, however, that only the Prussian State Bureau is a regular official institution with official authority and functions. The other organizations enjoy the aid and encouragement of the government, but they are not official.

Publications

A list of the publications of the State Bureau follows, as these are the most important among a very large literature concerned directly or indirectly with nature protection.

Beiträge zur Naturdenkmalpflege

These *Contributions to the Care of Natural Monuments* comprise the activities of the State Bureau, reports of conferences, and other papers regarding care of natural monuments. Primarily intended for scientific circles, administrative officials, and friends of nature, they pursue the object of encouraging the exploration, care and preservation of natural monuments in professional circles and beyond.

Band I. Berichte über die Staatliche Naturdenkmalpflege, 1906-1909 sowie über die 1. und 2. Konferenz. Die Naturdenkmalpflege in Dänemark. Reiterate über das Gesetz gegen die Verunstaltung von Ortschaften und landschaftlich hervor-

Vol. I. Reports of State Care of Natural Monuments, 1906-1909, and of the 1st and 2nd annual conferences. Care of Natural Monuments in Denmark. Discussion of the law against the disfigurement of towns and villages or of places of prominent

genden Gegenden 1907 und über Naturschutzparke. Anliegend einschlägige Gesetze, Erlasse und Verordnungen. Mit 36 Textabbildungen und 1 Tafel.

Band II. Die erratischen Blöcke im Regierungsbezirke Danzig mit botanischen Beiträgen. Berichte über die Eröffnung der Staatlichen Stelle in Berlin und über die 3. und 4. Konferenz. Erhebungen über das Vorkommen des Schwarzstorch und Fischreihers in Preussen. Geschichte der Naturdenkmalpflege in Schweden, Schutz der Naturdenkmäler in Norwegen u. a. m. Mit 30 Textabbildungen.

Band III. Das Plagefenn bei Chorin. Ergebnisse der Durchforschung eines Naturschutzgebietes der preussischen Forstverwaltung. Mit 25 Textabbildungen und 3 Tafeln.

Band IV. Bericht über die 5. und 6. Konferenz. Denkschrift über den Schutz der Natur Spitzbergens. Die geologischen Naturdenkmäler des Riesengebirges. Bericht über die Naturschutzsitzung beim russischen Naturforscherkongress in Tiflis, 1913, u. a. m. Mit 55 Textabbildungen und 2 Karten.

Band V. Die Pflanzenschutzgebiete in Bayern. Bericht über die 7. Konferenz. Denkschrift über die Notwendigkeit der Schaffung von Moorschutzgebieten. Das staatliche Vogelschutzgebiet an der alten Weichselmündung. Wandlungen der schlesischen Tierwelt. Mit 18 Textabbildungen.

Band VI. Bericht über die 8. und 9. Konferenz. Referate über die

scenic beauty 1907, and of Natural Parks. Included are laws concerning the above topics, decrees and regulations. With 36 illustrations in the text and 1 plate.

Vol. II. The Erratic Blocks in the administrative district of Danzig, with botanical contributions. Reports of the inauguration of the State Bureau in Berlin and of the 3rd and 4th annual conferences. Investigations as to the occurring of the Black Stork [*Ciconia nigra* L.] and the Common Heron [*Ardea cinerea*] in Prussia. History of the Care of Natural Monuments in Sweden, Protection of Natural Monuments in Norway, etc., with 30 text illustrations.

Vol. III. The Plagefenn near Chorin. Results of the exploration of a nature reservation of the Prussian Forestry Administration. With 25 text illustrations and 3 plates.

Vol. IV. Reports of the 5th and 6th annual conferences. Memorial regarding the protection of nature in Spitzbergen. The geological natural monuments of the Riesengebirge. Report of the Nature-protection Session at the Russian Naturalists Congress, in Tiflis, 1913, etc. With 55 text illustrations and 2 maps.

Vol. V. Plant reservations in Bavaria. Report of the 7th annual conference. Memorial regarding the "Importance of the Creation of Moor Reservations." The State Bird Refuge at the old Vistula mouth. Changes in Silesian animal life. With 18 text illustrations.

Vol. VI. Reports of the 8th and 9th annual conferences. Discussions

Seefelder bei Reinerz. Bericht über die Falz-Fein Sitzung in der Staatlichen Stelle für Naturdenkmalpflege in Preussen. Zur Reform des Vogelschutzrechts. Sicherung von Naturdenkmälern bei der bevorstehenden Kultivierung der Oedländereien. Ursprüngliches in der warmblütigen Tierwelt der Kriegsgebiete. Mit 10 Textabbildungen.

Band VII. Das Recht der Naturdenkmalpflege in Preussen. Dr. B. Wolf.

of the so-called Seefelder, at Reinerz, Silesia. Report of the Falz-Fein Session held in the State Bureau for the Care of Natural Monuments in Prussia. Regarding the reform of bird protection laws. Safeguarding natural monuments during the proposed amelioration of uncultivated tracts. Primitive peculiarities of warm-blooded animals and birds in the war regions. With 10 text figures.

Vol. VII. Laws and Regulations for the Care of Natural Monuments in Prussia. By Dr. B. Wolf.

Naturdenkmäler, Vorträge und Aufsätze

These pamphlets discuss individual themes of nature protection in popular form, and are intended to awaken the interest and understanding for the aims of nature protection in the public in general. The contents of the twenty-two booklets or pamphlets which have appeared are as follows:

1. Richtlinien zur Untersuchung der Pflanzen und Tierwelt besonders in Naturschutzgebieten.
2. Die Raubvögel als Naturdenkmäler.
3. Unsere erratischen Blöcke.
4. Zur rechtlichen Sicherung von Naturdenkmälern.
5. Vogelschutzgebiete an deutschen Meeresküsten.
6. Naturdenkmalpflege und wissenschaftliche Botanik.
7. Das Naturschutzgebiet bei Sababurg im Reinhardswald.
8. Schutz der blütenlosen Pflanzen.
- 9, 10. Schutz der geologischen Naturdenkmäler.
11. Schutz den heimischen Kriechtieren und Lurchen.
12. Der Drausen bei Elbing, eine Stätte ursprünglicher Natur.
13. Die Hülse oder Stechpalme, ein Naturdenkmal.

1. Methods of Investigating Plant and Animal Life, Especially in Nature Reservations.
2. Rapacious Birds as Natural Monuments.
3. Our Erratic Blocks.
4. Legal Safeguarding of Natural Monuments.
5. Bird Reservations on German Sea Coasts.
6. Care of Natural Monuments and Scientific Botany.
7. The Sababurg Reservation in the Reinhardswald.
8. Protection for Flowerless Plants.
- 9, 10. Protection for Geological Nature Reservations.
11. Protection for Native Reptiles and Batrachians.
12. The Drausen, near Elbing, a Place of Primitive Nature.
13. Holly or Thorn Palm [*Ilex aquifolium*] as a Natural Monument.

14, 15. Schwindende Vogelarten in Deutschland.

16, 17. Die Mistel.

18, 19. Das westfälische Industriegebiet und die Erhaltung der Natur.

20. Die Zehlau, ein staatlich geschütztes Hochmoor.

21. Naturschutz und Verkehr.

22. Die Nationalparke der Vereinigten Staaten.

14, 15. Disappearing Bird Species in Germany.

16, 17. The Mistletoe.

18, 19. The Westphalian Industrial Region and the Preservation of Nature.

20. Zehlau, a Moor Protected by the State.

21. Nature Protection and Traffic.

22. The National Parks in the United States.

H. Conwentz: Merkbuch für Naturdenkmalpflege und verwandte Bestrebungen, 1918. (Gebrüder Bornträger, Berlin).

H. Conwentz: Suggestions for the Care of Natural Monuments and Kindred Projects. 1918. (Bornträger Brothers, Berlin).

WILD LIFE AND DEMOCRACY

"Above all, the people, as a whole, should keep steadily in mind the fact that the preservation of both game and lesser wild life — by wise general laws, by the prohibition of the commercialism which destroys whole species for the profit of a few individuals, and by the creation of national reserves for wild life — is essentially a democratic movement. It is a movement in the interest of the average citizen, and especially in the interest of the man of small means. Wealthy men can keep private game preserves and private parks in which they can see all kinds of strange and beautiful creatures; but the ordinary men and women, and especially those of small means, can enjoy the loveliness and the wonder of nature, and can revel in the sight of beautiful birds, only on terms that will permit their fellow-citizens the like enjoyment. In other words, the people as a whole through the government, must protect wild life, if the people as a whole are to enjoy it. This applies to game also."

THEODORE ROOSEVELT and EDMUND HELLER.

Life Histories of African Game Animals.

Vol. 1, pp. 155-156, 1914.

CURRENT STATION NOTES

Acknowledgments

In this first number of the official serial publications of the Roosevelt Wild Life Forest Experiment Station, opportunity is afforded to thank those who have been friendly to the cause for which the Station stands and who have, in various ways, aided in advancing a movement for wild life research which was first championed by Theodore Roosevelt himself. Friends of Roosevelt and friends of the College have generously combined in supporting these plans. The Roosevelt family, the Trustees of the College of Forestry, our friends in the Legislature, the former Dean, Dr. Hugh P. Baker, the present Dean, Franklin F. Moon, and our Honorary Advisory Council, have all responded generously. Gratitude and acknowledgment is due the various authors, editors, and others who have contributed articles or have given permission to publish their papers; including Dr. George Bird Grinnell, Sir Harry H. Johnston, Dr. Gifford Pinchot, Mr. Edmund Heller, Mrs. George W. Perkins (for permission to publish the paper by her husband), Dr. T. G. Ahrens, and finally, to Mr. Ernest Thompson Seton for contributing the excellent and appropriate cover design for the *Bulletin*.

The College and the Roosevelt Station were greatly honored on October 11, by a visit from Mrs. Corinne Roosevelt Robinson, Colonel Roosevelt's sister. Her enthusiastic approval of the purposes of this Memorial and her recognition of its appropriateness was very gratifying indeed. Her interest was further shown by her accepting membership on the Honorary Advisory Council, and by a contribution to our fund for big game research in the Yellowstone. Mrs. Robinson's intimate account of Roosevelt's boyhood, as told in her book, *My Brother Theodore Roosevelt*, shows how clearly his interest in the living outdoor world was innate, and how natural it was that as a mature man he should comprehend the full meaning of conservation and be able to do so much for forestry and wild life.

Investigations in New York State, Summer of 1921

Through cooperation with the Commissioners of the Allegany State Park, of whom Hon. A. T. Fancher is Chairman, the Roosevelt Station has had a field party make a survey of the conditions of

wild life in this newly established State Park, which already contains 7,000 acres. Mr. Aretas A. Saunders, Field Ornithologist for the Station, has made a preliminary study and report on the birds. Prof. T. L. Hankinson, Station Ichthyologist, aided by Mr. W. A. Dence, Assistant, has made a study of the fishes of the region.

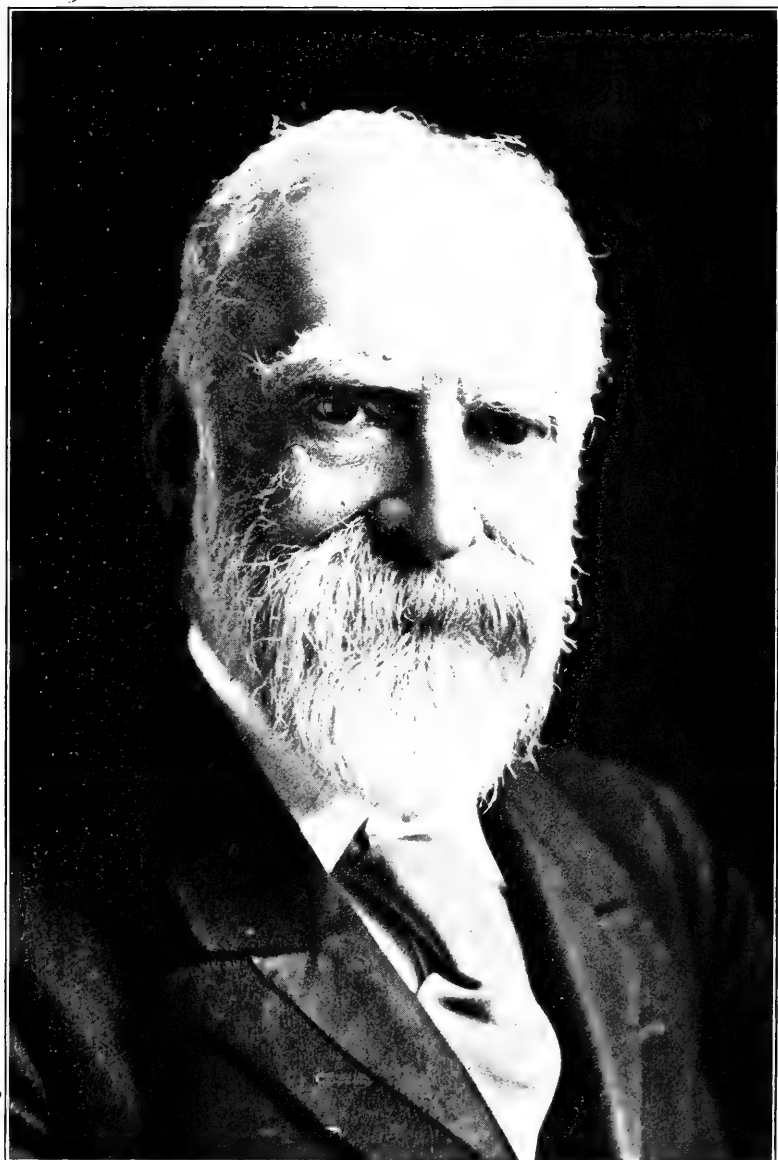
This same survey party extended its investigations of the fishes of Erie County, begun in 1920, with Buffalo as headquarters. This survey was made in cooperation with the Erie County Society for the Protection of Birds, Fish, and Game, of which Mr. J. C. Brennan is President, and the Buffalo Society of Natural Sciences, of which Mr. Chauncey J. Hamlin is President. Several local sportsmen gave very substantial aid in this survey.

Through the gifts of certain Trustees of the College of Forestry, an investigation has been made of the status of the beaver problem in Herkimer and Hamilton Counties in the Adirondacks, where the prolonged closed season on beaver has led to their excessive multiplication. This study has been made for the Station by Dr. Charles E. Johnson of the University of Kansas, who has been materially assisted by the officers of the State Conservation Commission, particularly by Commissioner Ellis J. Staley, Mr. Llewellyn Legge, Chief, Division of Fish and Game, and W. G. Howard, Assistant Superintendent of State Forests. He was also given much valuable assistance by the Forest Rangers.

Wild Life Research in Yellowstone National Park

Although the Station was founded by New York State, our activities are not limited solely to the State. Through the foresight of the Board of Trustees of the College of Forestry, our Charter provides that gifts and cooperation, when advantageous to the aims of the College, may be accepted, and research may be conducted wherever favorable. Through this wise provision not only are the College and the Station obligated to conduct statewide investigations on forest wild life, but as well are permitted to conduct wild life research in other regions.

Friends of the Roosevelt Station have sought its assistance and generously provided funds for conducting wild life research in our greatest wild life preserve—Yellowstone National Park. Through Mr. Howard H. Hays, President of the Yellowstone Park Camps Company, the Roosevelt Station has been able, with the approval and cooperation of Director Stephen T. Mather and Superintendent



VISCOUNT BRYCE

Member of Honorary Advisory Council

Horace M. Albright, to put a field party at work on important wild life problems in the Park.

The food of the stream fishes is being investigated by Dr. Richard A. Muttkowski of the University of Idaho, and Dr. Gilbert M. Smith of the University of Wisconsin. These are fundamental studies underlying the maintenance of the fish in the Park, a problem never having been studied before in this region. With the great increase of Park visitors and the excessive demand for trout fishing, the problem of maintaining the supply has become a very serious one. Mr. Edward R. Warren, the well-known authority on Colorado mammals, is making a detailed study of the beaver ponds and dams, which have been carefully surveyed and mapped. He has been assisted by E. J. Spackman, Jr. Mr. Edmund Heller, the eminent field naturalist who accompanied Roosevelt on his African expedition, is conducting an investigation of the large mammals of the Park, giving special attention to photographic records. He has been very materially assisted by a grant from two friends of the Station.

Governor Robert D. Carey, of Wyoming, an enthusiastic admirer of Roosevelt, showed his interest in the work of the Station by cooperating with Superintendent Horace M. Albright in aiding the Director to visit the Teton National Forest, south of the Park, the Two Ocean Pass region, and the upper waters of the Yellowstone River. The first-hand knowledge gained by this trip, as well as that secured in other parts of the Park, will be of special value in planning for future investigations in this region. Here occurs the Shiras Moose named in honor of Dr. George Shiras, 3rd, a member of our Honorary Advisory Council who has made extensive field studies of this animal.

The preceding statement indicates only the amount of substantial gifts and assistance which have been utilized, but does not include all that has been available to the Station. This proffered assistance, which for one reason or another could not be utilized, has nevertheless been much appreciated. Thus Mr. W. C. Gregg of Hackensack, N. J., volunteered to take a Station representative on his exploration trip through the southern part of the Park; and Mr. Hays offered facilities of which full use was not made.

The Assistant Director, Alvin G. Whitney, was given, during the past summer, a special leave of absence to conduct the "Forest and Trail Camp" for young men and boys in the Yellowstone National Park. His substitute during this absence was Mr. Aretas A.

Saunders. The fundamental idea of this camp-school is that the natural history resources of such a wonderful region as the Park should be made the basis for a unique educational experience which is believed to be vastly superior to the conventional games and athletic sports dominating so much of the activities of summer camps. It is an excellent practical demonstration of the value of nature guiding in the best sense of the word.

The facilities of this Camp were generously made available to the field party of the Station (see p. 38), and this cooperation was greatly appreciated by the Station and the individual workers. The presence of such a member on our staff and the familiarity with conditions in the Park which Prof. and Mrs. Whitney possessed, was a leading factor in developing our cooperative Park plans and very naturally is keenly appreciated.

Publications

The results of the foregoing studies will in due time be published. Many causes have contributed in delaying the publication of the earlier investigations of the Station. The prospects now indicate an early publication of manuscripts which have accumulated during several years. The Station has been able to secure the valuable services of Mr. Ernest Ingersoll for assistance in this editorial work.

Wild Life Library

The establishment of a wild life library is one of the distinctive features of this Memorial Station. This library is intended to include not only books, magazines, and other publications but as well manuscripts, notebooks, photographs and all forms of valuable data on forest wild life. Already a valuable nucleus of wild life photographs and negatives have been accumulated, and the field workers of the past season have made many important additions to this series. There is a real need for repositories of this sort where, under proper care, the materials will be available for use by the public. In addition to valuable books purchased, other publications, including books, magazines and pamphlets have been received as gifts, so that this library is constantly growing.

Station Staff Changes

The Station regrets very much to announce the resignation of Thomas L. Hankinson, Ichthyologist of the Station. His work began with the College in 1915 and continued each summer on a tem-

porary appointment until January 1, 1919, when he became Ichthyologist on the Station staff. His resignation took effect October 1, 1921. While engaged in fish surveys he has, working with others, made studies of the fish of Oneida Lake, of the Palisades Interstate Park region, and the Allegany State Park; and through his interest the Erie County fish survey was initiated. He is a very competent field naturalist, whose enthusiasm for studying the life history and habits of fish has been a life-long passion. It is through the Station having on its staff such a specialist that it has been able to cooperate with various other State agencies and local organizations in its various fish surveys. He leaves the Station with its best wishes for his future success.

The Station is fortunate in being able to announce at this time that Dr. William Converse Kendall, Scientific Assistant and Ichthyologist of the United States Bureau of Fisheries at Washington, D. C., has accepted the position as Ichthyologist made vacant by the resignation of Mr. Hankinson. Dr. Kendall cooperated with the Station, through the U. S. Bureau of Fisheries, in our study of the fishes of the Palisades Interstate Park. He has devoted years to the study of trout and is our leading authority in America on the Salmonidae. His well-known paper, *The Rangeley Lakes, Maine; with Special Reference to the Habits of the Fishes, Fish Culture and Angling*, is one of the most important studies of its kind ever published in this country, and is only one of a large number of interesting and important papers published by him. The Station is very fortunate in securing such a competent man.

The Fifth Anniversary

The twenty-ninth of December is the fifth anniversary of the presentation of the original plans for forest wild life research to Colonel Roosevelt, and at that time they received his cordial approval. However, on account of the War, these plans were not developed until after his death, when they became the basis for this Memorial Station, in May, 1919. Since then investigations have been conducted on forest wild life in the Adirondacks, in the Palisades Interstate Park, in the Allegany State Park, and during the past summer investigations were started in the Yellowstone National Park. Thus several of the most important features of the original plans are already under way.

THE ROOSEVELT WILD LIFE MEMORIAL

As a State Memorial

The State of New York is the trustee of this wild life Memorial to Theodore Roosevelt. The New York State College of Forestry at Syracuse is a State institution supported solely by State funds, and the Roosevelt Wild Life Forest Experiment Station is a part of this institution. The Trustees are State officials. A legislative mandate instructed them as follows:

"To establish and conduct an experimental station to be known as 'Roosevelt Wild Life Forest Experiment Station,' in which there shall be maintained records of the results of the experiments and investigations made and research work accomplished; also a library of works, publications, papers and data having to do with wild life, together with means for practical illustration and demonstration, which library shall, at all reasonable hours, be open to the public." [Laws of New York, chapter 536. Became a law May 10, 1919.]

As a General Memorial

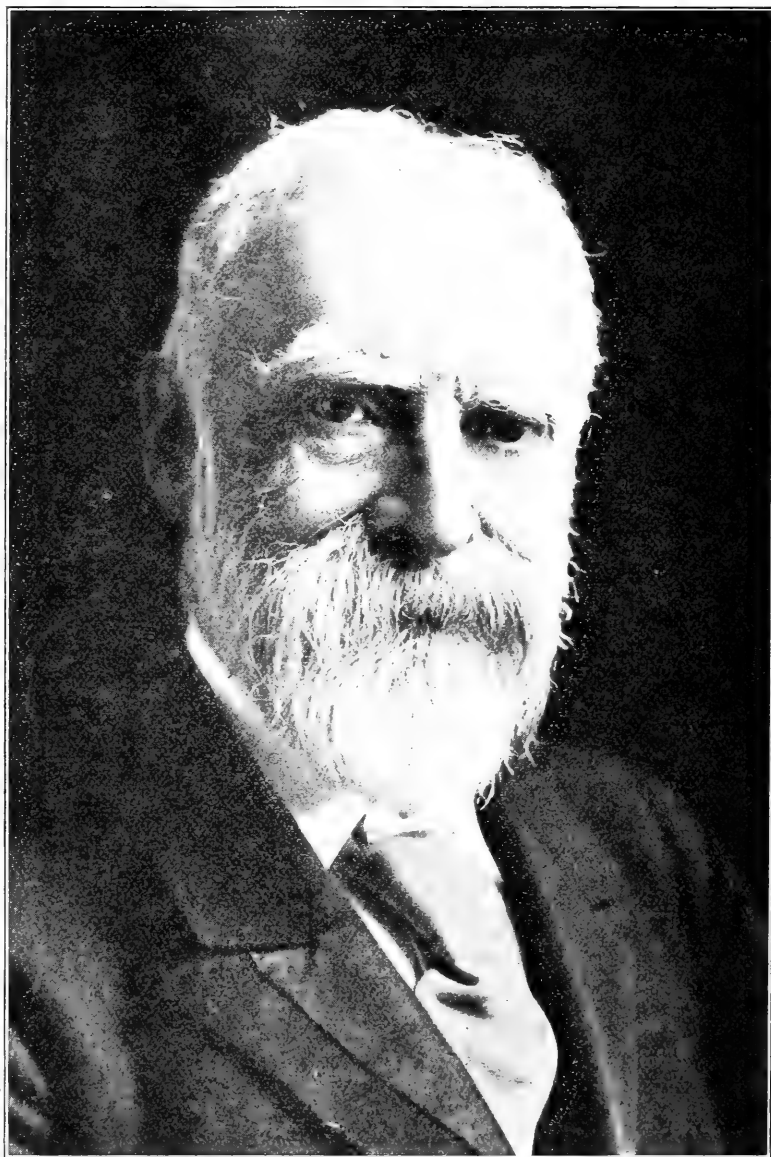
While this Memorial Station was founded by New York State, its functions are not limited solely to the State. The Trustees are further authorized to cooperate with other agencies, so that the work is by no means limited to the boundaries of the State or by State funds. Provision for this has been made by the law as follows:

"To enter into any contract necessary or appropriate for carrying out any of the purposes or objects of the College, including such as shall involve cooperation with any person, corporation or association or any department of the government of the State of New York or of the United States in laboratory, experimental, investigative or research work, and the acceptance from such person, corporation, association, or department of the State or Federal government of gifts or contributions of money, expert service, labor, materials, apparatus, appliances or other property in connection therewith." [Laws of New York, chapter 42. Became a law March 7, 1918.]

By these laws the Empire State has made provision to conduct forest wild life research upon a comprehensive basis, and on a plan as broad as that approved by Theodore Roosevelt himself.

Form of Bequest to the Roosevelt Wild Life Memorial

I hereby give and bequeath to the Roosevelt Wild Life Forest Experiment Station of The New York State College of Forestry at Syracuse, for wild life research, library, and for publication, the sum of, or the following books, lands, etc.



THE LATE VISCOUNT JAMES BRYCE
1838-1922.
Late Member of Honorary Advisory Council

Roosevelt Wild Life Bulletin

(VOLUME I, NUMBER 2)

OF

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OF

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AT

SYRACUSE UNIVERSITY



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The Serial Publications of The Roosevelt Wild Life Forest Experiment Station consist of the following:

1. **Roosevelt Wild Life Bulletin.**
2. **Roosevelt Wild Life Annals.**

The *Bulletin* is intended to include papers of general and popular interest on the various phases of forest wild life, and the *Annals* those of a more technical nature or having a less widespread interest.

These publications are edited in cooperation with the College Committee on Publications.

Exchanges are invited.

CHARLES C. ADAMS

Director and Editor

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M. P. SKINNER.....Roosevelt Field Ornithologist

* Including only those who have made field investigations and whose reports are now in preparation.

** Resigned as Station Ichthyologist October 1, 1921.

ROOSEVELT ON WILD LIFE INVESTIGATION

"There must be ample research in the laboratory in order even to present those problems, not to speak of solving them, and there can be no laboratory study without the accumulation of masses of dry facts and specimens.

"I also mean that from now on it is essential to recognize that the best scientific men must largely work in the great out-of-doors laboratory of nature. It is only such outdoors work which will give us the chance to interpret aright the laboratory observations."

THEODORE ROOSEVELT.

THE RELATION OF FORESTS AND FORESTRY TO HUMAN WELFARE

"Forests are more than trees. They are rather land areas on which are associated various forms of plant and animal life. The forester must deal with all. Wild life is as essentially and legitimately an object of his care as are water, wood, and forage. Forest administration should be planned with a view to realizing all possible benefits from the land areas handled. It should take account of their indirect value for recreation and health as well as their value for the production of salable material; and of their value for the production of meat, hides, and furs of all kinds as well as for the production of wood and the protection of water supplies.

"Unquestionably the working out of a program of wild life protection which will give due weight to all the interests affected is a delicate task. It is impossible to harmonize the differences between the economic, the esthetic, the sporting, and the commercial viewpoint. Nevertheless, the practical difficulties are not so great as they appear on the surface."

HENRY S. GRAVES,
Former Chief Forester, U. S. Forest Service.
Recreation, Vol. 52, p. 236, 1915.

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HENRY S. GRAVES
Member of Honorary Advisory Council

AN OPPORTUNITY FOR GREAT PUBLIC SERVICE

BY HENRY S. GRAVES

Dean, School of Forestry, Yale University

*Member of Honorary Advisory Council, The Roosevelt Wild Life
Forest Experiment Station, Syracuse, New York*

One of the most encouraging signs in recent years has been the changing public attitude toward the conservation of wild life. There is an increasing volume of public protest against the unintelligent destruction of wild life that still characterizes many parts of the country. Of special significance, however, is the growing appreciation of the value of wild life to the people of the nation. We are beginning to realize also that the perpetuation and right use of wild life involve much more than the enactment of perfunctory legislation and the employment of politically appointed game wardens.

Wild life is now seen to be a natural resource whose conservation and proper utilization are of real service in advancing the welfare of our people. While many persons may still think of wild life conservation as primarily of benefit to a limited group of people who have a taste for shooting and fishing and who can afford to indulge in it, their number is rapidly diminishing. The objectives of those behind the new movement of wild life conservation are much broader and more far reaching than this. It is a good deal like the good roads movement. There are many who see in it special advantages for pleasure drives for owners of automobiles, and the builders of motor vehicles may be strongly back of the movement for better roads. But the main objectives of good roads are the opening of the country to commerce, the development of communities and creation of new and more comfortable homes, the stimulus to the use of undeveloped land, and the establishment of new industries, as well as the encouragement to people to come more closely in contact with nature.

The protection of bird life is no longer a fad of a few sentimentalists. It is a practical problem of safeguarding the farm, field, garden and forest from insect pests. The depletion of our fisheries takes on new significance now that the price of fish in the market is approaching that of choice meats. In many forest regions the people are beginning to see that an abundance of game and fish is attracting to their communities thousands of visitors who bring large benefits

to the local communities. Farmers are making the discovery that the presence of wild life in pasture and woodland is a real financial asset. Purely on the economic side it has been shown that the meat value of the big game which is killed each year in the country amounts to no less than 15 million dollars and that effective game administration would in the long run increase this many fold. The economic value of the wild life resource is so great that the country can no longer afford to neglect the necessary measures to perpetuate and increase it.

There is another side to the problem of wild life conservation, however, which is just as important and which fortunately is being increasingly appreciated. I refer to the part played by wild life in attracting people to the country for recreation and for the mental and spiritual stimulus that comes from a contact with nature. The movement for outdoor recreation is not primarily designed for amusement. It is to furnish the benefits that are derived from a complete relaxation and change from the routine duties of life and the inspiration that is derived from an intimate touch with the fields and woodlands and with the rugged scenery of the mountains. These benefits will be expressed in better health, greater efficiency, and a more wholesome point of view for those who are able from time to time to visit the points of interest in the country that are now being made readily available.

One of the great attractions to draw the people into the country is an abundance of game, birds and fish. Many vacation visitors are interested in wild life chiefly for the opportunities offered for sport. The largest purpose of providing such sport through the conservation and proper utilization of wild life is the benefit of a sojourn in the great out-of-doors. But there is an increasing number of people who derive enjoyment in observing game just as they enjoy the forests, the trees and flowers. More and more the study of wild life is becoming a pastime, for scientific study, for game photography, for the mere pleasure of contact with conditions where wild life finds its home.

The conservation of wild life is peculiarly a public problem. In the first place the game and fish belong to the public itself, which holds it in trust for the benefit of the people of the country. An individual does not actually own the fish and game which may abound upon his property. Even if the game and fish within the boundaries of his property are the result of expenditures in protection and in breeding, they still belong to the public and he can utilize them only under the state laws. He can exercise a certain

control over the wild life on his land because he can prevent trespass, but if it should go beyond the boundaries of his tract he cannot recover it as in the case of domestic animals. The wild life resource within a given state does not represent the aggregate of property owned by individuals in the state but it is an asset of very great value owned by the people as a whole. There is therefore a direct responsibility on the part of the public to safeguard and perpetuate it.

The existence of private preserves and the efforts of individuals to protect the wild life upon their property through the trespass laws and to increase it through special measures are of great assistance. Many private individuals find that the benefits, financial or otherwise, derived from having an abundance of wild life upon their property are such as to induce them to take measures for its conservation. Such private efforts are not, however, in the aggregate sufficient to insure the perpetuation of the wild life resources. Greed and selfishness, indifference and unintelligence are still operating to deplete and in some places actually exhaust the fish and game and to make necessary stringent laws and a much more effective administration of them than is general in the country today.

Very frequently we make reference to the former days when the forests abounded in game and the streams with fish. We are only just beginning to realize that we now face very different conditions from those existing when there was a wilderness of greater or less extent in nearly all regions of the country. The wilderness is rapidly vanishing. Everywhere we are building roads to make accessible the most remote parts of the country. The very movement for outdoor recreation which we are encouraging in every way is increasing the difficulties in the conservation of wild life. Under these conditions we have the task not only to maintain the wild life without further depletion but also the problem of restoration and rebuilding where wild life has been exhausted or is approaching exhaustion. Still again the advance of industry, of agriculture, of stock raising and other phases of land utilization, is in many instances restricting the natural home of wild life and frequently the land formerly used by game for winter feeding grounds and for breeding is now occupied for industrial activities.

The old idea that a little protection is all that is needed for the perpetuation of wild life is no longer applicable. This is a tradition from frontier conditions when the population was still so small and the wilderness so large that the balance of nature could easily be maintained or, if impaired, could be restored. Nature is very pro-

lific. Its power of recuperation under abuse is astonishing, but the adverse factors are becoming so great that the wild life can no longer sustain itself without very definite measures of assistance. We now begin to see that the rule-of-thumb methods of protection are no longer adequate. We must provide an administration of wild life by the public which is based upon a knowledge of the habits and life history of the different species, upon a knowledge of their specific requirements for food and for breeding places, a knowledge of their productive capacity, a knowledge of their natural enemies and diseases, etc. Such knowledge can be obtained only through intelligent study and scientific research. We must have laws for the protection of wild life, but no laws can be applied automatically. There must be provision also for intelligent administration adapted to the requirements for building up the supply of wild life. The principles of public policy expressed in legislation and the methods of administration will depend upon the results of the studies of scientific agencies.

New York State possesses a wild life resource which has a direct economic value of many millions of dollars and an indirect value to the people that cannot be measured. Very wisely the State has now provided for research and experimental work that will lay the foundation for maintaining and increasing this resource. The opportunities before the Roosevelt Wild Life Forest Experiment Station for public service are very exceptional. Liberal support should be given to it to make possible the conduct of investigations of the most thorough scientific character. Through the work of this institution sound knowledge will replace guesswork as a background for the public policies and for field practice in matters pertaining to wild life in the State.

It is a gratification that the Experiment Station is intimately related to forestry. Certain classes of wild life make their home in the forests. No forester can overlook the increased service of the forest through the presence of game and fish. In many instances the provision for the needs of game constitutes an important factor in the plans of developing and administering a forest. More and more the responsibility for protecting and supervising the game and fish will fall upon the foresters themselves. As they show their competence, the public will increasingly place the work in their hands. The work of the Roosevelt Experiment Station will be of great educational value to foresters, not only through the results of the research but in demonstrating the intimate relation between forestry and wild life conservation.

AN INVESTIGATION OF THE BEAVER IN HERKIMER AND HAMILTON COUNTIES OF THE ADIRONDACKS*

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* In the first program presented to Theodore Roosevelt for the investigation of wild life, provision was made for an intensive study of the beaver; but funds for such an investigation were not forthcoming until Dean Franklin Moon called the attention of the Trustees of the New York State College of Forestry to this need, whereupon several of them responded with personal contributions which supplemented by a contribution from the College, together with the hearty cooperation of former Commissioner Ellis J. Staley of the New York State Conservation Commission, have made the present reconnaissance possible.—The Director.

Introduction

The following report is the result of a preliminary survey undertaken for the Roosevelt Wild Life Forest Experiment Station of the New York State College of Forestry at Syracuse, which has been based upon field work extending from July 27 to September 9, 1921. The area chosen for the investigation lies in northern Herkimer and Hamilton counties along the southern border of the Adirondack Mountains. This territory, according to information furnished by Mr. W. G. Howard, Assistant Superintendent of Forests, of the New York State Conservation Commission, marks the center of abundance of beaver in the Adirondacks, and from this area have come the most insistent reports of damage resulting from activities of these animals.

On the accompanying maps (maps 1 and 2) are shown the localities visited by me personally in the course of the investigation and also other sections, according to definite information given me by Forest Rangers and other persons, in which beaver are now to be found. This does not mean that beaver may not be present in the localities which are unmarked on the maps. In designating the position of beaver dams and lodges the maps at my disposal were on too small a scale to permit exact location, so that places marked represent only an approximation. While the maps show all the dams and lodges actually seen by me, and recorded on the spot for each stream and pond as far as they were explored, it is to be expected that a number may have escaped my notice. This is especially true in the upper courses of many creeks visited, where more beaver works would undoubtedly have been found had there been sufficient time to search for them. It was apparent after a few days in the field that it would be out of the question, in the time available, to examine personally all the localities in which beaver probably occurred. In regard to many places which I was unable to visit I obtained information from the Forest Rangers, and the locations of the dams were marked on the map as indicated. The Rangers expressed their conviction that most of the streams in all of this region have at least a few beaver somewhere along their courses.

Care was taken to record all lodges observed in order to have a basis for an estimate of the beaver population. In so doing it was, of course, necessary to distinguish between occupied and abandoned lodges. In some localities many beavers do not build lodges, but live in holes in the banks, and allowance must, therefore, be made for



Fig. 1. Constable Creek, one of the sources of Big Moose Lake. View above second beaver dam from mouth of creek.



Fig. 2. Constable Creek, about a hundred yards above view in figure 1; showing beaver lodge and flooded woodland.



Fig. 3. Constable Creek; another view of the beaver flow. Mixed birch and spruce forest.



Fig. 4. Constable Pond, looking toward the outlet. Fringe of spruce timber under water.

these. Likewise along some streams the beavers do not build dams. Where dams occur they alone do not furnish any safe index to the number of animals engaged, for a family of beavers may build one dam or several as conditions may prompt them. The visible results of beaver operations are frequently all out of proportion to the number of animals involved in the performance. A dam built by a single individual or by a pair of beavers, if placed in a favorable situation may cause such an extensive flooding or flow as to lead one to believe that a dozen or more had been engaged on it. With sufficient time in a given locality it is quite possible to arrive at a fairly close estimate of the number of beavers, by careful watching for the animals themselves and by examination and comparison of various signs, but obviously in a large area and with limited time only a rough estimate could be made. However, lodges and dams taken together give at least some idea of the character of the distribution of the beavers along the streams; and from this one may draw tentative conclusions as to the density of the beaver population. In the regions investigated the Rangers were always asked to direct or take me to the localities, if accessible, which were known to have the largest number of beaver and where the most extensive damage was being done.

A short account of the natural history of the beaver is included, as Part II, in this report because such knowledge of its behavior is a necessary background for any intelligent understanding of the beaver problem, and it may be of use, also, to the large number of visitors and dwellers in the Adirondacks who are interested in wild life and who do not have access to reliable information. To most people who enjoy the out-of-doors, the beaver with its wonderful instincts, has a fascination equalled by few other animals. By reason of its shy and retiring habits, when living where it is frequently disturbed, it is seldom seen by the visitor to its native haunts, and is therefore known to him chiefly by its works. These works, which are often on a large scale, seem so perfectly adapted to the animal's needs and so similar to human engineering that one is readily led into accepting them as the product of a directing intelligence of a very high order. It is not strange that many fanciful tales have been written and told about this master builder of the wilds.

I wish to acknowledge the helpful coöperation given me in the prosecution of this work by the officials of The New York State College of Forestry and the Roosevelt Wild Life Forest Experiment

Station, as well as by former Commissioner Ellis J. Staley of the New York Conservation Commission, Mr. W. G. Howard, Assistant Superintendent of Forests, and Chief Llewellyn Legge of the Division of Fish and Game. For assistance in the field I am indebted to the Forest Rangers of the Conservation Commission, and especially to Mr. David Conkey of Beaver River, and Mr. Isaac B. Robinson of Long Lake, in whose districts the most of my time was spent and who placed all their available time at my disposal. Mr. Howard kindly placed in my hands maps and reports which greatly facilitated my work.

PART I. STATUS OF THE BEAVER IN HERKIMER AND HAMILTON COUNTIES

Relation of the Beaver to the Timber

It may be safely stated at the outset that wherever beavers occur in a wooded region, a certain amount of damage to forest trees of one kind or another, large or small, is an inevitable accompaniment of their presence.

In the region covered by this investigation the damage to timber appears to be the most definite and serious charge placed against the species at the present time. This charge at least has the virtue of being susceptible to ocular proof. The seriousness of this kind of damage of course depends upon its magnitude. In 1919, according to Commissioner George D. Pratt, of the New York Conservation Commission ('20, pp. 48-51), Forest Rangers estimated that a total area amounting to 8,681 acres had been flooded as a result of beaver dams in the Adirondacks and that the merchantable timber that had been killed or was being killed in this area had an estimated value of \$51,425.00. In this report 587 beaver dams had been counted, which comprised only a part of all the dams scattered throughout the Adirondacks. In 1920 this damage had been increased ('21, p. 101) by \$3,410.00, or to a total of about \$55,000.00.

Damage to timber by beavers results from two activities of the animals: (1) The cutting or girdling of trees, and (2) the damming of streams and ponds.

Damage through Cutting and Girdling of Trees. The total damage done by cutting or girdling of trees of all sizes and descriptions is entirely negligible in comparison with that resulting from flooding. The beaver, however, like the lumberman, is wasteful in his methods and much that is cut down is not utilized. As a general



Fig. 5. Constable Pond; flooded bay at inlet. Drowned timber chiefly of spruce.



Fig. 6. One of the dams on Outlet Creek of Lower Gull Lake; 146 feet long and 8 feet, 8 inches high.



Fig. 7. Twitchell Creek; view a half mile west of highway. Spruce timber, long since drowned.



Fig. 8. Outlet Creek of Russian Pond; showing dam two and a half feet high, damaging timber along the stream.

rule I have found the beaver more extravagant and destructive when he is working in a locality of large trees, than where small growths of the same kind of trees occur, because when a sapling up to three or four inches in diameter is felled, the bark not only of the branches but also of the entire trunk is utilized for food, while in the case of larger trees, eight to ten inches in diameter and above, usually only the limbs are selected; and often most or even all of these are left untouched.

During this investigation in the Adirondacks the amount and kinds of cuttings were found to vary considerably with the locality. When aspens, or poplars, as they are locally called, occurred in fair abundance among other kinds they of course were the principal trees cut. Next in order came the birches, and in many localities these were the most common cuttings, not from choice but because of scarcity or absence of the more favored aspen. The largest beaver-cut trees found were birches and aspens measuring from 12 inches to 17 inches in diameter at the lower end of the cut. Young beeches were occasionally found cut, and many small maple saplings; also, in burned-over districts, many small wild cherry trees and a considerable number of larger ones, three to six inches in diameter. Other kinds of trees or shrubbery cut by beaver were alders, willows, raspberry, ash, spruce, hemlock, balsam fir and pine. The spruce, balsam fir and pine were all of small size, an inch or two in diameter, and were merely such occasional cuttings of conifers as one usually finds in beaver haunts. One hemlock a foot in diameter was cut about two-thirds through, and a little one near it had been completely severed. Trees of various kinds were frequently seen which had been merely girdled and then permanently abandoned.

Damage through Flooding of Timbered Areas. No attempt was made by me to estimate the number of acres of timber of any sort flooded in the various localities. Such estimates have however, been published (Pratt '20, p. 50). Many beaver flows contain no merchantable timber, while others contain patches of it here and there. The actual acreage is in the very nature of the conditions difficult to estimate with any degree of accuracy without detailed surveys.

To give a detailed account of all or even most of the many localities where timber of one kind or another, and in very variable amounts was found damaged or killed in beaver flows, appears neither necessary nor desirable at this time. In order, however, to

convey some idea of the situation as actually encountered it will be important to describe conditions in a number of localities in the principal areas investigated. For this purpose I have selected all the beaver flows in which the most extensive damage was found, some examples to show where little or no damage has resulted or is likely to occur, and others which represent fairly average conditions or noteworthy features in other respects.

1. *Big Moose Lake Region.* The most extensive flooding and killing of timber in one continuous body is found along Constable Creek (map 1). From within approximately half a mile of the mouth of this creek, which is in Big Moose Lake, and extending to Constable Pond, there is a belt of drowned timber which, according to my estimate, varies in width from about 10 rods at the lower end to perhaps 18 or 20 rods as it approaches Constable Pond; from there a much narrower fringe extends along the north and south shores of the pond. At the eastern end of the pond the two fringes meet in a bay into which empties Pigeon Creek, and this bay contains a close stand of dead timber, the bulk of it is spruce. The entire distance of this flow is about two miles. On the creek I located five dams in repair. The smallest of these was near Big Moose Lake and was about 25 feet long and only 15 inches high, between the water levels. It was in good repair when I saw it although it had been repeatedly torn out previously, as it was on private land; therefore no damage had resulted from this dam. The next dam, approximately half a mile up stream, was about 40 feet long and 1 foot 6 inches high and marked the beginning of the long flow (figure 1). The uppermost dam was the largest, being about 300 feet long and 4 feet high between the upper and lower water levels. In the stretch included between the second and the uppermost dam four beaver lodges were found, two of them inhabited and possibly also the third, while the fourth had been abandoned. Figures 2 to 5 inclusive show the conditions as they were found in this flow. It will be noted that much of the timber is mixed spruce, birch and balsam fir which at the time it was killed constituted a rather young growth in a cut-over district, the trees being about 5 to 8 inches in diameter and smaller. Constable Creek offers a good example of the effects of beaver dams of very moderate size and relatively few in number when placed across small streams normally only a few feet wide but whose banks are low.

As an example of a type of stream where little damage to timber can result even from large dams, may be mentioned the creek form-



Fig. 9. Lower Gull Lake; dam at outlet flooding narrow fringe of forest around the lake.



Fig. 10. The lower of the Two Sisters Lakes; dam at outlet flooding a fringe of spruce timber.



Fig. 11. Beaver pond at junction of Sunshine and Jack Pond Creeks, Twitchell Lake district.



Fig. 12. Dam at outlet of Oswego Pond, Twitchell Lake district. This has flooded an area extending half a mile above the pond.

ing the outlet of Lower Gull Lake. Seven dams were encountered on this stream. Two of these were the highest found in this region, and are located about half way between Lower Gull and Big Moose lakes. The lower dam was 119 feet long and 6 feet high at the stream's channel. The upper one was 146 feet long and measured 8 feet, 8 inches in height. The banks of the creek are here rather steep, the area covered by the ponds above the dams was very small and the damage by flooding negligible. These dams were of several years' standing (figure 6).

2. *Twitchell Lake Region.* Twitchell Creek, just west of the road, presents a stretch of timber of respectable size killed by beaver flows of past years, although in this part of the creek I saw no evidence of present activity. Figure 7 is a typical example of what I found along this creek for a distance of about a mile below the road. Three abandoned lodges and three old dams that evidently had been torn out by human hands were observed in this distance.

The ponds and lakes in the Big Moose-Twitchell lakes region, which were visited and found to have dams across their outlets, are Chub Pond, May's Pond, Big Chief Pond, Russian Pond, lower Two Sisters Lakes, Lower and Upper Gull lakes and Queer Lake. At the outlet of the last named is a recently constructed dam as yet small so that the water level of the lake has not been seriously affected. On the outlet creek of Russian Pond is a dam about 65 feet long and 2 feet, 6 inches high, situated approximately 40 rods below the pond itself (figure 8). The dam has not damaged the pond because of the slope of its shores, but between the pond and the dam is a belt of drowned timber averaging probably 65 to 70 feet in width. The timber is mostly small spruce and the amount of damage is not serious. Below the dam the creek is about ten feet wide.

At the outlet of Lower Gull Lake is a dam about 90 feet long and 2 feet, 6 inches high, followed by two smaller dams at seventy-five foot intervals down-stream. The shore line of the lake has a fringe of dead trees, small or medium sized, which varies perhaps from 30 to 50 feet in width. The dam at the outlet is shown in figure 9, while figure 11 shows a flooded bay on the west shore.

Upper Gull Lake presents similar conditions but at the time of my visit the water had gone down considerably as the result of disrepair of the dam at its outlet.

The lower of the Two Sisters Lakes has a narrow fringe of dead trees of small size along the north shore and in a bay east of the

outlet. Where the outlet stream leaves the lake there is a new dam 117 feet long and 2 feet, 6 inches high. The ground bordering the outlet is low and the dam has caused a flooding of probably two or three acres of timber, mostly fair-sized spruce, which is dying. Figure 10 shows the dam at the outlet.

Lily-pad Pond (Twitchell Lake district) is surrounded by a belt of dead timber about 40 to 60 feet wide, chiefly medium-sized spruce. This pond and a small one to the southwest of it, originally separate, have now been made into one pond as a result of beaver flows. At the outlet of this greater pond is a dam 85 feet long and 3 feet, 9 inches high. The water above it at the time of my visit was 8 inches below the crest of the dam which had been torn open at one end by men, and had not yet been repaired by the beavers. The condition of the neighboring Little Birch Pond is similar.

At the outlet of South Pond is a dam 90 feet long and 3 feet high; but the banks are steeper here and the amount of dead wood as a consequence is negligible in quantity.

A beaver pond formed at the junction of what is known locally as "Jack Creek" and "Sunshine Creek" is shown in figure 11.

The greatest damage to timber in any one patch in this district is about Oswego Pond (figure 12), especially along the small creek entering it from the west. Here the flooded area extends for half or three-quarters of a mile upstream from the pond. On the inlet creek from the northeast seven dams were found, one of which was about 100 feet long and 3 feet high. Towards the upper limits of this creek the banks are higher and no serious damage is likely to occur.

In both the Big Moose Lake and the Twitchell Lake districts about all the damage to timber that can result from beaver dams has already been accomplished. This statement is supported also by the expressions of the District Ranger and local inhabitants.

3. *Beaver River Region.* One of the smaller lakes of this region is Loon Lake. Across the outlet on its northeast side is a dam about 60 feet long and 2 feet, 6 inches high. As a result of this dam there are patches, covering perhaps three or four acres, of recently drowned spruce and cedar on the northwest and northeast shores. The southwest shore at the inlet, contains a larger patch, my estimate being in the neighborhood of seven or eight acres.

A small creek known locally as the "North Branch" enters the



Fig. 13. Witchopple Lake; view of part of northwest shore and dam at outlet.



Fig. 14. View along inlet creek of Witchopple Lake. Because of the low banks this beaver flow is submerging considerable spruce timber.



Fig. 15. New dam on outlet stream of Razorback Pond, on property of Champlain Realty Company. Stand of large spruce above dam endangered by flooding.



Fig. 16. Beaver flow on creek entering Round Pond, northern Long Lake region.

Beaver River Flow from the northeast, almost due north of Beaver River Station. The beavers have just recently started their building operations here and three dams not more than a foot or a foot and a half high have been placed across the creek near its mouth. The ground bordering is very low and it is necessary only to raise the water a few inches in order to affect perhaps eight or ten acres of spruce in which are included a number of very large pines. A part of this timber is already turning yellow.

The most extensive damage to timber in this district is at Witchopple Lake. At the outlet of this lake is a dam about 175 feet long and 2 feet, 6 inches high between the water levels (figures 13). On the adjacent northeast shore is a patch of dead timber, and a belt also extends eastward along the same shore, visible in the photograph. The greater part of the lake shore, however, is still unaffected because of the incline of the ground. The full effect of the dam may be seen along the inlet stream at the northeast end of the lake. Because of the low ground bordering this creek the high water of the lake has inundated the banks the full length of the stream, from Witchopple Lake to what is called "Beaver Dam Pond," a distance of approximately half a mile. The width of the dead timber belt was estimated to vary from about 20 to 25 or 30 rods. The timber is predominantly spruce. Figure 14 is a view along this creek.

At Woods Lake complaint had been made in regard to a new beaver dam on the creek which is the outlet of Razorback Pond. The dam in question was found to be about 55 feet long and 1 foot, 10 inches high, firmly anchored against large boulders (figure 15). The ground above it is low and the dam is favorably placed for flooding a comparatively large area with but slight increase in its height. A fine stand of spruce is already in water and unless the dam is torn out this timber will be damaged.

4. *Sabattis Region*. In this territory (map 2, insert), according to Ranger Willard Sutton, the damage to timber has been insignificant because the land has previously been denuded by logging and fires. But a case of beaver trouble of a different sort was met with here which may be mentioned at this point. About two miles northeast of Sabattis station the New York Central Railway crosses the outlet creek of Little Trout Pond. This creek is normally a very small stream and a tile culvert forms its conduit under the roadbed. A beaver dam a short distance down stream has

backed up the water so as to form a pond on both sides of the embankment. In addition to this the beaver continually plug up the culvert, I was informed by one of the section crew, so that the men were obliged to tear out the obstruction every day.

5. *Long Lake Region.* Round Pond lies east of Long Lake in Township 50 (map 2). Where the southwest inlet creek enters the pond there is a dam which rather recently has flooded and killed several acres of timber extending upstream along the creek. On the northern tributary of this creek are two dams of considerable size, only a short distance apart. The upper one measured 125 paces in length and was 1 foot, 6 inches high. A belt of dead timber estimated to be from 12 to 18 rods wide extends upstream from these dams for a distance of about half a mile (figure 16).

On Pine Brook, a short distance to the north of Round Pond, there is a dam, about a mile distant from Long Lake, which is 100 feet long and 4 feet, 4 inches high between water levels; measured from the bottom the dam is 8 feet high. It is situated at a narrow part of the brook, with low ground just above it where a large pond has resulted (figure 17). Beginning with the pond the dead timber, which is rather small, extends upstream for a distance of about a mile. This is cut-over land, and farther upstream the creek flows through a burned area where beaver dams are of no consequence so far as timber is concerned.

Entering Long Lake on the east shore, Township 22, lot 50, is an insignificant stream known as "Old Landing Creek." This was explored for a distance of about three miles. Three dams were located, the largest of which was 150 feet long and 5 feet, 3 inches high from the bottom. These dams had been torn open on August 18 by Ranger Isaac Robinson and the beaver had as yet, August 26, made no attempt to repair them. Among the many large birches and spruces killed in the ponds were four large pines, the largest measuring 7 feet, 9.5 inches in circumference, waist high.

On the small stream entering Lake Eaton (locally known as "Clear Lake") from the southwest, and about ten minutes' tramp from the lake, at the junction of two tributaries, is a dam 110 feet long and 7 feet high at the stream's channel. The pond above covers about one and a half or two acres. The larger trees that have been killed are birches measuring 9 inches to a foot or more in diameter. A number of smaller dams occur on one of the tributaries, but some of them have recently been abandoned.



Fig. 17. Beaver pond on Pine Brook, northern Long Lake region. Chiefly cut-over and burned land, so that damage from flow is negligible.



Fig. 18. Aspen 17.5 inches in diameter, cut by beaver; north shore of Lake Eaton.



Fig. 19. Salmon Brook, Blue Mountain Lake region: dam 75 feet long and 3 feet high, causing flow about a mile in length.

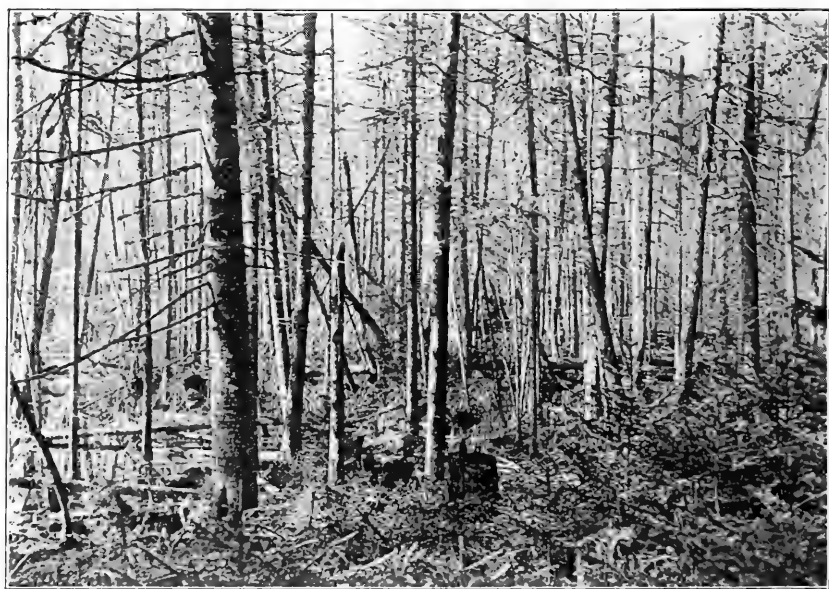


Fig. 20. Salmon Brook, Blue Mountain Lake region. Dead spruce timber in the long flow on this creek.

On the west shore of Lake Eaton were found the largest beaver-cut aspens encountered; the largest measured 17.5 inches in diameter at the lower end of the cut, the others 12.5 inches, 16 inches, 16.25 inches, respectively (figure 18).

6. *Forked Lake Region.* At the eastern end of this lake a stream from the north enters the North Bay. A swath of dead timber killed by beaver flows some years ago extends upstream for about half a mile. From there on, beaver operations in progress at the present time have caused some further damage. Approximately a mile from the mouth of the creek occurs the largest recent flow met with on this stream, where about four or five acres of spruce trees from 6 to 10 inches in diameter are standing in water and have begun to turn yellow. This is a locality of low ground which is easily flooded.

I was informed by Ranger Robinson about a large beaver flow on the Whitney Preserve, along Sperry Brook below Handsome Pond. Mr. Robinson's plans for taking me to this locality were unfortunately thwarted by the occurrence of fires in his district which required his close attention. This flow west of Long Lake, is by far the largest in that general region, according to Mr. Robinson.

7. *Blue Mountain Lake Region.* The most extensive beaver flow in this ranger district occurs on the Salmon Lake stream. About half way between Salmon Lake and the road to the west of it there is a dam across this stream which is 75 feet long and 3 feet high (figure 19). A flow containing a belt of dead timber perhaps 12 rods wide extends upstream for a distance of approximately one mile. Near the road is another large dam which has been abandoned. The dead timber in the long flow consists of rather small or medium-sized spruce and balsam fir mixed with birch (figure 20).

On the neighboring Mud Pond inlet stream, where it parallels the highway, may be seen a beaver flow with dead timber for a stretch of about a quarter of a mile.

8. *Indian Lake Region.* In this region none of the beaver flows which I had opportunity to examine had been so destructive to timber as the major ones mentioned for other regions. As an example from this territory may be mentioned the private land of Lot 41, in Township 17. On a small creek on this property (McCabes Creek) were located three small dams which had been torn open. As the result of a flow that had previously been caused

by these dams there is a belt of dead spruce estimated to be from 10 to 12 rods in width and about a half mile in length. The trees standing at present are rather small, 4 to 6 inches in diameter, the larger ones having been cut off by the owners. Figure 21 gives a view along this creek.

Beaver Flows Compared with other Sources of Dead Timber.

The foregoing examples may be sufficient to show the effect of beaver flows upon timber. However, one need not spend much time in the Adirondacks to realize that the beaver constitutes only one of a number of agencies that have been operative in the destruction of timber, and that it is not the most important factor. The total of windfall and the timber destroyed by fire undoubtedly far exceeds the damage that has been caused or is likely to be caused in years to come by the beaver. Then there is the timber drowned as the result of dams constructed by man, as for example the Beaver River Flow. Waste in lumbering operations has previously been alluded to. In the Long Lake region in one or two places I walked on corduroy tote roads constructed for hundreds of yards from sound forest trees of various kinds cut for this purpose and then left to rot. If this timber were measured I believe that it would be found to equal or exceed in amount that killed in some of the largest beaver flows that came under my observation.

Indeed the Forest Rangers with whom I talked frankly admitted that the actual loss of timber from beaver operations was comparatively not a serious matter. The destruction by beaver of course occurs only along those watercourses where conditions are suitable for or permit of their damming operations, and to that extent it is limited. The dead timber in beaver flows impresses the observer rather forcibly because it is highly localized, usually standing, and therefore conspicuous.

Relation to Forest Fires. In the opinion of one Forest Ranger in whose district there occurred relatively large beaver flows the most serious aspect of the situation was that the dead timber in these flows constituted a potential fire menace; that as the beaver dams in time would be abandoned and would gradually disintegrate, the receding water would leave exposed masses of dry timber, standing and fallen, in which from lightning or other causes destructive forest fires might originate. This point may be well taken, but it obviously follows that to destroy the dams or kill off the beaver



Fig. 21. McCabes Creek, Indian Lake region; spruce killed in beaver flow.



Fig. 22. Creek entering inlet marsh, Big Moose Lake; view just below junction of the north and south forks. Formerly a good trout stream.



Fig. 23. View on Pine Brook, between Forked Lake and Long Lake, taken just above a beaver dam which had been torn out. Formerly a good trout stream.



Fig. 24. Beaver ponds on small tributary of Boulder Brook; stream normally about two feet wide. No timber to damage here.

in such places would be to artificially and speedily bring about just such a hazardous situation. In a state of nature where beaver are present in some numbers it would seem that dams thus abandoned by one group of animals would soon be re-occupied by another group and the period of fire risk would be relatively short, if food was available.

While it is doubtless true that the dead timber in beaver flows may at certain times and under certain conditions become a fire menace, it is none the less true, as another Ranger pointed out, that beaver flows themselves constitute effective fire-breaks. Elsewhere the fire protective value of beaver ponds has been pointed out in Canada ("He Would Conscript Beaver as Fire Rangers" *Canadian Forestry Journal*, Vol. 14, p. 1656, 1918.) and in Wisconsin by Forester F. B. Moody ('16). Streams a few inches or a few feet wide are frequently transformed by the beaver into series of ponds or flows rods in width and hundreds of yards in length, and whether they be in heavily forested parts or in more open, cut-over or formerly burned areas (figure 25) the barrier afforded by such flows may on occasion prove of considerable importance in a fire protection system. Were a sweeping fire to arise in the Adirondack woods it is quite certainly true that every beaver flow, large or small, that might be found in the path of the fire would be taken advantage of by the fire fighters as lines of defense. Every effort would be made to drive the fire into these flows. In this connection the practical value of accurately mapping all the beaver flows is apparent. Mr. W. G. Howard, Assistant Superintendent of the State Forest, New York Conservation Commission, sends the following comment: "In reference to the advantage or disadvantage of beaver flows in connection with fire protection, I will say that my feeling is that these flows are more of a disadvantage than they are an advantage. They make it impossible to maintain good passable trails, and therefore render communication difficult. It is my feeling that this disadvantage far outweighs any advantage which might accrue from having a wider strip of water than would be obtained from the natural stream."

Effect on Logging Operations. In addition to loss of values in timber, lumber or pulp, logging operations also may be adversely affected more or less permanently. Streams used for driving logs, or the tributaries of such streams, it is charged, may have their waters diverted or held up by beaver dams so that there is insuffi-

cient depth to carry the logs. Sluices may be continually choked up by the beaver, necessitating constant vigilance on the part of someone to keep them open. Where many beaver ponds exist, exposing a large surface area, the evaporation and retarded flow may be sufficiently great in dry periods to reduce materially the amount of water necessary to run logs. According to Mr. H. D. Cornwall of Glenfield this loss may be as high as 10 to 15 per cent.

In this connection it would seem that the beaver is not altogether an unmixed evil. There are small streams favorably situated in logging areas which normally would serve no useful purpose to a logging concern. As a result of beaver dams such a stream might, at least in a part of its course, be converted into an avenue of transportation, not necessarily for logs, though that also might be possible, but for supplies, and thus be not without a degree of usefulness. I met with an instance in the Adirondacks where a beaver flow offered easy transportation of supplies to a fishing club for a distance of probably half a mile or more where without this means considerable time and labor and perhaps expense would undoubtedly have been entailed. In other regions than the Adirondacks, I have many times been personally grateful for the presence of beaver flows that afforded me easy passage by canoe or boat to localities otherwise inaccessible.

Salvaging of Drowned Timber. Any person tramping about in the Adirondacks cannot, I am sure, avoid a feeling of regret that all the dead wood in the beaver flows, and elsewhere for that matter, cannot be taken off and made use of in some way. It is true that most of it is soft wood and not of a desirable kind even for fuel, but there is much sound wood of harder varieties that might be utilized not merely for fuel but possibly for lumber for certain purposes, *if taken in time*. While accessibility and transportation difficulties are no doubt deterrent factors it would seem that the inhabitants of the region in many places should be able to clear off a part of this dead wood. From what I learned in conversation with a number of thrifty residents I believe that many of them would be glad to avail themselves of the opportunity if it were permissible for this to be granted by the State. *In many of the localities that I visited about all the timber that can be reached by beaver flows has already been killed*. While the dams in these places will continue in repair so long as the animals remain, there is little likelihood that they will continue to grow greatly in height and indefinitely



Fig. 25. Beaver dam and pond on upper courses of Pine Brook, Cold River region; limit of a burned area. A good example of a beaver flow as a natural fire barrier.



Fig. 26. Part of meadow formed on site of old beaver pond; Grampus Lake stream, Long Lake region.



Fig. 27. Big Chief Pond, Big Moose Lake region. Part of south shore; beaver-damaged timber removed. An example of injury on a private estate.



Fig. 28. Beaver dam on Big Brook, Long Lake region; 172 feet long, 3 feet, 9 inches high; no timber to damage here. Beaver flows are frequently helpful to man for transportation purposes.

extend the belt of dead timber. The shore line in these places shows that the present high water level of the ponds has been constant probably for years. If therefore the dead wood were to be cut off—and this could be best done in winter — the appearance of the ponds would be improved, and the possible fire hazard removed. For out-lying localities this might not prove feasible, but for ponds and along streams which it may be particularly desirable to restore to an attractive condition for the benefit of summer visitors, I see no great difficulty.

Summary of Localities Visited. The following is a list of the ponds and streams whose shores I have personally examined and which contain more or less timber damaged by beaver flows.

Constable Creek.

Constable Pond

Chub Pond.

Big Chief Pond.

Andes Creek.

North Branch, Big Moose Inlet stream.

Upper Gull Lake.

Twitchell Creek.

Lily-pad Pond.

Little Birch Pond.

Jack Pond.

Loon Lake.

North Branch, Beaver River Flow.

Witchopple Lake and inlet creek arising in Beaver Dam Pond.

Razorback Pond outlet stream.

South Branch, Beaver River Flow.

North inlet stream of Lake Lila.

Peaked Mountain Pond.

Stream in Township 21, Lot 95, near Long Lake Post Office,
and streams in Lots 107, 108.

Pine Brook (Forked Lake region).

Round Pond, and also creek entering from southwest and small
northern inlet.

Pine Brook (Cold River region), lower courses.

"Old Landing Creek" (Long Lake region).

Southwest inlet of Lake Eaton.

North Bay Brook (Forked Lake region).

McCanns Brook (Blue Mountain Lake region).

Salmon Brook.

Creek on McCabe's and Cross's land (Indian Lake region).

Stream in Township 15, Lot 43 (Indian Lake region).

Streams and ponds about which damage to timber is lacking or is negligible in quantity:

Queer Lake.

Lower Two Sisters Lake.

Russian Pond.

Pigeon Creek.

Lower Gull Lake outlet stream.

Twitchell Creek, east of highway.

Outlet stream of South Pond.

Northeast inlet of Oswego Pond.

Salmon Lake (Witchopple Lake district).

Greater part of Witchopple Lake shore line.

Upper sources of South Branch (Beaver River region).

Upper sources of Shingle Shanty Brook.

Mud Pond outlet stream.

Hitchcock Lake.

Long Pond (Sabattis region) and outlet stream.

Thayers Brook (Long Lake region).

Grampus Brook.

Big Brook (Long Lake region), greater part of brook between
Grampus Lake stream and Rock Pond.

Calkins Brook, lower part.

Small pond bordering Calkins Brook.

Cold River, lower part.

Latham Pond and outlet stream.

Boulder Brook and small tributary to west of it.

Pine Brook, for most of its length (exceptions in its lower
course, Lots 55, 56).

Mud Pond (Walker Preserve), and outlet stream.

Sargents Ponds, the western and the middle one.

Cedar River, main stream.

Spragues Pond outlet stream (Indian Lake region).

Salmon Lake (Blue Mountain Lake region).

Relation to Waters, Fish and Fishing

Some persons consider that the most important relation of the beaver in the Adirondacks is to the waters and fish of the ponds

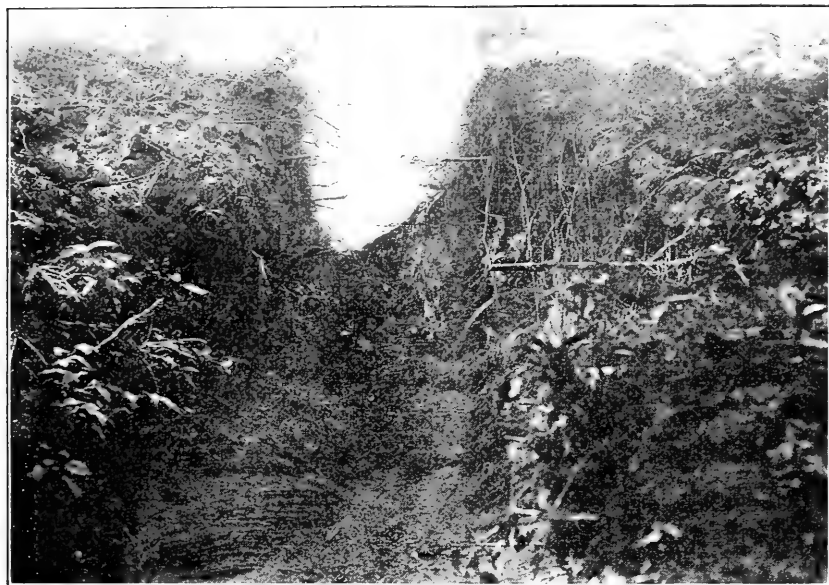


Fig. 29. Beavers' "tote road," cut through river bank; near Cold River.



Fig. 30. White birch with double cut having spiral turn. Tree on edge of little knoll; 3 feet. 7 inches in circumference above upper cut. Big Brook, Long Lake district.



Fig. 31. Hemlock one foot in diameter, partly severed by beaver; Loon Lake, Beaver River district.



Fig. 32. Small dam containing many stones; outlet of Trout Pond, Beaver River district.

and streams. About this whole subject however, little can be said that rests upon a basis of established fact, and until it has been carefully investigated all that can be said about it must be accepted merely as expression of opinion, based upon evidence that is largely circumstantial. Two opposing views were encountered: one maintaining that the presence of beaver is distinctly harmful to trout; the other that it is beneficial. The conflicting opinions represent, I am sure, honest convictions gained by different experiences; and it is highly probable that there is some truth in both views; that in some situations the results may be harmful and in others beneficial and under other conditions the effect may be neutral.

Arguments Against the Beaver in Relation to Trout. The harmful effects of the beaver upon Adirondack trout has been discussed by former Commissioner George D. Pratt ('21, pp. 117-118). This adverse opinion was probably that of John W. Titcomb, the Fish Culturist of the Conservation Commission at that time. See also *The Conservationist*, Vol. 4, p. 173. These effects are supposed to arise in three ways: (1) by dams acting as barriers to the movements of trout; (2) by excessive warming up of the water in the beaver ponds; (3) by the changing character of the water itself in the beaver ponds,—possibly rendered toxic to a sensitive fish like the trout.

1. *Beaver Dams as Barriers.* Where beaver dams in considerable numbers occur on a trout stream it is believed that the fish will be unable to surmount these barriers when in the fall of the year they seek their spawning grounds upstream. This is supposed to be true, especially in the case of the higher dams, but just how high a dam it takes to prevent trout from passing to the pond above is not known. If dams do deter trout from ascending, then, no doubt, a great many are penned in between dams all along the stream. A beaver dam with its projecting sticks and boughs obviously presents a different and more difficult obstacle from that of a low natural fall or rapids.

2. *Effect of Flows on Temperature of Water.* When the trees and bushes in a beaver pond die, the summer sun is given unobstructed play upon an expanse of shallow water. In these ponds changes of water are slow because of the arrested current. The heating process is aided by the evaporation which tends to keep the water at a low level. The cool water of springs feeding into the ponds is neutralized, the springs being "killed," according to a local expression.

3. *Influence of Flows on Character of Water.* The water in most streams below beaver ponds as well as in the ponds themselves is more or less amber-or coffee-colored. This is thought to be due to dissolved substances from trees, especially hemlock, from peat or from decaying vegetable matter of various kinds. This kind of water is believed to be injurious to trout, whether it is warm or cold. The belief rests upon the experience that before the beaver came the water in these streams was clear, the trout were plentiful and fishing excellent. With the appearance of the beaver the water changed, the trout gradually diminished in numbers and within a few years the streams were abandoned as fishing grounds.

A number of streams which I visited were pointed out to me as having formerly been the best trout streams in their localities. As an example may be mentioned the creek, with its two branches, emptying into the inlet marsh of Big Moose Lake (map 1). I was informed by Mr. H. H. Covey, proprietor of Camp Crag, and by others, that these creeks before the introduction of the beaver were among the best trout spawning grounds of that region. Their waters were perfectly clear and considerably deeper than they have been since that time; there was excellent trout fishing. Now no trout are found in them and they have long since been abandoned by fishermen.

I found the creek (figure 22) from its mouth up to the junction of its two branches averaging perhaps 25 to 30 feet in width. Its depth 2 feet, 6 inches at the mouth, 3 to 4 feet in the channel farther upstream, and 6 feet at the junction of its two branches. The bottom felt firm under the oar, consisting of mud well mixed with sand. On each branch, a few rods from the junction, is a beaver dam. The one on the south branch is about 18 inches high between water levels and perhaps 30 to 35 feet long. The water just above the dam was 2 feet, .7 inches deep; bottom firm and sandy under the oar. The greatest depth encountered was 6 feet, 3 inches, at a point about 50 yards above the dam. A short distance farther upstream the creek becomes narrow and fallen trees prevent further progress by boat. The water at this point was 2 feet, 6 inches deep and the bottom was covered with an inch or two of soft mud, but below this it felt as firm and sandy as it did below the dam.

The dam on the north branch, about the same distance from the junction, is 25 feet long and 2 feet high between water levels.



Fig. 33. The large dam on McCanns Brook, Blue Mountain Lake district;
11 feet, 1 inch high at the creek's channel.



Fig. 34. Part of one of the wings of the high dam shown in figure 33.



Fig. 35. Huge beaver lodge on Cold River; longest diameter 35 feet; shortest, 28 feet; height 7 feet.



Fig. 36. Inhabited lodge. Sargents Pond (easternmost).

This dam had been dynamited twice by Mr. Covey during the week preceding my visit. The beaver repaired it quickly each time and except for the wreckage of the old dam below there was little evidence that the structure had been damaged. Immediately above this dam the water was 4 feet, 9 inches deep. The bottom was of the same character as elsewhere. The pond above the dam is about 50 feet across, its west shore is swampy, and it contains grassy hummocks and clusters of dead trees. Beyond the dam upstream for a distance of about 150 yards the creek has an estimated average width of about 25 feet. Midway in this distance the depth measured 4 feet, 11 inches, and at the upper end the depth was 3 feet, 3.5 inches; bottom as before. Beyond this point, which marks the limit of progress by boat, the creek is so shallow that the bottom can be seen in the brownish water. Other dams and similar conditions occur at intervals along its course.

The water of both the north and south branches is coffee-colored so that where the depth is greater than about 20 to 24 inches the bottom cannot be seen. In a cup of water however, the tinge appears very slight.

Other waters which were particularly pointed out to me as having been excellent trout streams before the arrival of the beaver are Constable Creek, the beaver works on which have previously been described; Pine Brook, a tributary of Raquette River between Forked Lake and Long Lake; Oswego Pond (figure 12) in the Twitchell Lake district; and Loon Lake, in the Beaver River region. Pine Brook, according to Ranger Robinson, has in the past been one of the best streams for trout both as to size and numbers. For a time after the beaver came it continued to offer good fishing; then trout became less and less plentiful until now no one goes fishing there (figure 23).

Opinions Favorable to the Beaver. Champions of the view that beaver are beneficial rather than harmful to trout are not wanting. On the trail to Queer Lake, Big Moose Lake region, I met a party of fishermen consisting of Mr. Frank Davis and his son, of Mohawk, N. Y., and their guide, Mr. Hobart Casler. Mr. Davis was emphatically of the opinion that the beaver are not responsible for the scarcity of trout and the poor fishing complained of by many people. He mentioned in support of his statement, Queer Lake itself, in which there were plenty of trout although small, that is less than 6 or 7 inches in length. That they

were plentiful was in itself evidence that trout were thriving and propagating there. Other waters he named were Crooked Lake and Stony Lake. On a stream connected with the former he said there were 15 beaver dams, but that last spring there was as good if not better fishing in this stream than ever before. Mr. Davis declared that he had been coming into the Adirondacks for years to fish and was thoroughly familiar with the conditions. Each succeeding year he had been obliged to seek more and more remote places in order to find good fishing. The cause of this, he firmly believed, was not chargeable to the beaver but to a class of people who make a practice of taking under-sized fish. The extension of roads throughout the Adirondacks had made a steadily increasing area easily accessible to numbers of unscrupulous persons who have little regard either for the spirit or the letter of the law. The gradual depletion of trout in the ponds and streams is the result. Meanwhile the true sportsman becomes discouraged and provoked, and occasionally perhaps may be unaware of the true situation and places the blame in the wrong place.

Mr. Casler, although having no patience with the beaver, which he believed ought to be exterminated, agreed with Mr. Davis that there is a prevalent practice with some classes of people of taking quantities of under-sized trout.

Another champion of the beaver was found in Mr. H. H. Fish of Indian Lake. Mr. Fish informed me that he had been a guide for many years and had been a consistent defender of the beaver in its relation to trout. He mentioned as examples where fishing was never better than it was after beaver came, Buell Brook and Cedar River Flow. Beaver dams, according to Mr. Fish, permit the formation where springs come in, of deep, cool pools, highly favorable to trout. More food is found in the beaver ponds and the trout as a consequence grow larger. Mr. Fish admitted, however, that under certain conditions or in certain localities beaver dams might have harmful effects, such as preventing movements of the trout upstream in spawning time, hindering circulation of the water or allowing of its being warmed to an unfavorable degree in mid-summer.

For further testimony favorable to the beaver I am indebted to Dr. Howard Lilienthal of New York City. In a letter of September 30 last he informs me of a conversation he had with "one of the best guides in the Big Moose Lake region" who stated "that

the only difference made by the beavers so far as trout fishing went, was that the flooding of the land gave the trout so much food and bottom interest that they did not rise to the fly. He did not believe that it made any actual difference in the number of trout nor in their spawning." Abundance of food must be looked upon as a thing favorable to trout though not necessarily to trout fishing.

That trout in beaver ponds often do not rise to the fly or take bait seems to be borne out by an experience of my own in Colorado a few years ago. Numerous attempts to catch trout in pools between beaver dams resulted in most discouraging failure, but that trout were there in numbers I had abundant ocular proof.

In Minnesota, Mr. Carlos Avery, State Commissioner of Game and Fisheries, made a preliminary inquiry into the relation of beaver to trout and concluded that the relation was a favorable one. Mr. Eben W. Cobb, Superintendent of Fisheries there, states that: "Wherever I have heard the matter spoken of by trout fishermen it has been stated that the trout grow larger and the fishing is better in the ponds caused by these dams and that they offered a safe retreat for trout during a period of the year when anchor ice was running, and also during the hot months of summer as the trout are safer in the deeper waters during this period." (Cf., "Beaver make for better trout fishing," *Fins, Feathers and Fur*, No. 22, p. 10, 1920, and Lawrie '21).

Balancing of Opinion. On the basis of my own observations, I am inclined to believe that there may be a good deal of truth in both of the conflicting views set forth above. The differences probably are to be sought in the differing local conditions. A shallow, relatively broad stream with low banks and feeble current, if dammed by beaver, results in a series of expansive but shallow ponds. If contributing springs are few, small and far between, dams frequent and the soil composed of humus, unfavorable conditions of one kind or another quite probably develop on such a stream. In the original condition with freely flowing water and cool shade, trout may have thrived, but in the altered circumstances one would hardly expect them to do so. On the other hand, a stream of like size with good current, higher banks, and with springs more frequent, might by the same number of dams be converted into a stream in every way more favorable to trout than it was before. There would be an increase in the depth of the water without an undue spread at the sides; the entering springs would

furnish cool pools and perhaps an entire lower stratum of cool water; and with the increased volume of water would come an increased food supply.

Mr. H. D. Cornwall, in a letter of September 7 last, informs me of a conversation he had had with a woodsman who told him of "having seen trout and bullheads dead and others in a very much weakened condition swimming on the surface of water in ponds caused by beaver dams on small streams where in low water the condition is such that there is not sufficient new water coming into the pond to freshen it." A similar experience was related to me by Ranger David Conkey in connection with beaver ponds which had gone down as a result of disrepair of the dams. While I personally saw a number of ponds that had been lowered to such an extent that a large part of the bottom was exposed, I did not happen to see any evidence of dead or dying fish, although it is possible that sufficient search might have revealed them. A decided stench was noticed in one or two such places but so far as I could determine it seemed to arise from decaying vegetable matter.

There would seem to me to be little doubt that conditions in some beaver ponds may readily become fatal to certain fishes, the trout probably being more sensitive than other species in the Adirondack streams. In periods of drought during the summer months, with partial or complete drying up of the springs, it is possible that in the beaver-dammed streams there may be an excessive accumulation especially of carbon dioxide and nitrogen, these gases arising in the silt and humus on the bottom of the ponds; for according to Shelford ('13, p. 60), "Nitrogen and carbon dioxide are produced especially near the bottom and if the water did not circulate they would be too abundant in some places and deficient in others for animals to live." Again (pp. 59-60), "Several workers have shown that carbon dioxide is very toxic to fishes. . . . Fishes for example turn away when they encounter as small an increase as 5 c.c. per liter of carbon dioxide. Since a large amount of dissolved carbon dioxide is commonly accompanied by a low oxygen content as well as other important factors, the carbon dioxide content of water (strongly alkaline waters excepted) is probably the best single index of the suitability of the water for fishes." Further (p. 133), "Analyses of the bottom water from ponds with humus-covered bottoms showed that it contained no oxygen. The open

water of the lakes with the incomplete circulation in summer is without sufficient oxygen to support life, below the level of circulation." M. C. Marsh ('10, p. 896) makes this statement: "The water soluble substances in bark and in the wood of some trees are capable of killing fishes, but while such products are undesirable in streams the amounts of bark and wood necessary to affect fish in flowing streams are so large that it is not likely that they do much direct damage to fishes by the substances which dissolve from them." An inference that may be drawn from this last quotation is that in waters with arrested circulation, as for example beaver ponds under certain conditions, the water soluble substances in question may accumulate to a degree sufficient to be fatal to trout and other species of fish.

In the light of what has been said above it is evident that a scientific investigation of a number of representative beaver-inhabited Adirondack streams in their relation to trout would not only be of important scientific interest but would have much practical fish cultural value also. The conditions obtaining in the streams before as well as after the entrance of beavers should, of course, be ascertained and their history followed over a period of years.

Advantages of Beaver Dams and Ponds. Despite the possibilities for harm enumerated above, beaver dams in the Adirondacks cannot be viewed solely in an unfavorable light. There as in other regions, beaver ponds unquestionably serve in many places, as previously noted, as reservoirs of water which keep creeks running during dry seasons, and in other localities may have important value as fire barriers (figures 24 and 25). In periods of heavy rains or at the break-up of the streams in spring they may become very useful in retarding or absorbing agencies to a degree sufficient to prevent minor floods. Furthermore, the formation of bottom land and meadows through the activities of the beaver is a matter of some economic value. It is well known that thousands of acres of agricultural land in the United States have been formed as the direct result of beaver dams. In some localities at the present time the principal grazing lands available are the grassy meadows that originated in beaver ponds. Figure 26 illustrates such a meadow found along the Grampus Lake stream in the Long Lake region. The photograph was taken from an old grass-grown dam which at one time had held back a large pond of water. The mud and silt that had been carried down by the stream and settled in

the pond furnished soil in which a heavy crop of grass was destined to spring up after the dam should eventually be abandoned. This actually happened, and when I was there the usefulness of the old beaver dam to present human inhabitants was evidenced by the fact that the meadow had recently been cut for hay.

The beaver ponds act as settling basins for the inwashed soil which, when carried downstream, silts up the channels and destroys the breeding grounds of fishes, as well as fills the channels so that they easily overflow their banks during heavy rains. The importance of these influences has not been and is not now adequately recognized.

Relation of Beaver Work to Deer in Winter and to Water Birds

It was believed by Ranger Conkey that beaver ponds, at times in winter, caused some distress among deer because of the raised water level which permits the freezing over of spring entrances where deer are accustomed to drink. In their eagerness for water the deer as a consequence may attempt to get it in places difficult to reach. He mentioned three instances where he had found deer that had gotten into water holes to drink and from which they were unable to get out. Ranger Isaac Robinson, on the contrary, does not believe that this question of water is a serious one. He told of seeing many places where deer had regularly passed by open water without turning aside to drink, their trails in the snow showing this plainly. As the deer eat snow freely, he held that they were not at all dependent upon open water.

Another point brought out by Mr. Robinson was the claim of some old guides that beaver ponds destroy a great deal of the winter food of the deer. He had not himself seen any clear proof of this. The food alleged to be destroyed particularly is the young growth of balsam fir; but also other vegetation or shrubbery found in the swamps where many deer spend the winter. The idea is that deer often form the habit of retreating to the same swamps where they have previously wintered and if such a locality should in the meantime have been flooded they would find their feeding grounds restricted. This theory assumes that the animals either out of sheer stupidity or attachment for a local area remain there and suffer from lack of food instead of seeking better foraging grounds elsewhere.

Mr. H. H. Fish, guide at Indian Lake, holds a quite contrary

view. He asserts that deer do not keep so closely to the swamps in winter as many people seem to think, but frequently go feeding in numbers on the very tops of the hills. He had himself witnessed this many times. Instead of being detrimental to deer beaver flows were, in his estimation, distinctly an advantage, in that they not only afforded refuges from persons who practice night hunting, but also because they made travel so difficult under other methods of hunting that the deer were given a better chance to escape.

Mr. H. H. Covey pointed out as one of the objections to the beaver, that the little grassy meadows or margins so frequently occurring along the shores of streams or ponds and forming favorite feeding places of deer during the summer months, are often submerged by the beaver flows. The deer are thus driven away from the watercourses to more inaccessible places. The harm in this is that summer guests are deprived of one of their chief delights, that of seeing deer. He mentioned particular localities where prior to the coming of the beaver visitors might daily enjoy the sight of deer but where now the animals are rarely or never seen.

Relation to Certain Water Birds. A point that may be worthy of mention is the common occurrence of the Black Duck (*Anas rubripes*) that was noted about the beaver ponds in the Adirondacks. On many occasions I saw what in all probability were locally hatched broods of this species. They were observed most frequently in the older beaver ponds and in flows along streams with exposed muddy shores and plenty of cover in the form of dense stands of alders, windfall timber or other dead wood.

Other water birds observed in or about beaver flows were: Great Blue Heron, common; Hooded Merganser, occasional,— the American Merganser also being seen a number of times on natural ponds and once on Cold River; American Golden-eye, occasional; Solitary Sandpiper, fairly common.

Relation to Private Holdings within the Adirondack Preserve

From the owners of summer cottages or of camps (inns) on lake fronts came the chief complaints heard in the course of the investigation. Owners of large private preserves, where many beaver are probably found, were not personally met with and their attitude toward the beaver was consequently not learned; but from what was observed their problem is mainly that of preventing areas of timber land from being flooded. This requires constant vigilance on the

part of the keepers. Of the former group most of the complaints were heard in the Big Moose Lake district. I learned of five lake front properties here which had been molested more or less by the beaver. On one property, situated on a point in what is known as North Bay, I counted 9 aspens immediately about a cottage, which had been felled by beaver probably within the last year. The trees ranged from 4 to 10 inches in diameter. One had been felled so as to lodge against the cottage roof. Altogether I counted 32 birches and aspens, chiefly the latter, felled on this property; but a number of scattered cuttings were probably overlooked, for the owner informed me that 42 beaver-felled trees had been counted last spring. I saw at this place also a white pine 2 inches in diameter that had been cut rather recently, and 4 smaller ones that were a part of a newly planted group. A number of shade trees had been protected by means of wire netting. In a neighboring yard an aspen had been slightly gashed by beaver two nights previous to my visit.

Most damage of this kind is done during the period of the year when the people are not at their summer cottages. The resentment of the owners is but natural. They take pride in making their grounds attractive and trees are a fundamental part of such a scheme. A beautiful tree that has required many years to grow may be cut down overnight; it cannot soon be replaced. Furthermore, in some instances trees may have a sentimental value as in a case met with where one had been planted by a member of the family since deceased.

Of course much can be done to prevent such depredations of the beaver, by surrounding the more valuable trees with wire netting; but where larger patches of forest are concerned this is not practicable, though a common enclosure might be sufficient in many cases.

The most extensive cuttings on private grounds in the Big Moose Lake district were on the property of Dr. Albert Van der Veer. A pond on this property, known as Big Chief Pond, is shown in figure 27. It is about a hundred yards in diameter and was formerly a very pretty body of water. In addition to trees killed by flooding, due to a beaver dam across the outlet which more recently has been kept open, the doctor estimated that approximately 200 trees had been cut down by beaver about this pond in the last ten or twelve years. A number of stumps of beaver-felled birches which I measured there ranged from 6 to 15 inches in diameter.

Wherever beaver depredations affect smaller property owners

they are as a rule more keenly felt than they are in the case of owners of large estates. Certain camp owners whose patronage consists of summer visitors are concerned about the relation of the beaver to the ponds and streams of their vicinity. Their contention is that with the decline of fishing and with the marring of the beauty of ponds and streams these places no longer offer attractions to their guests and a loss of patronage is the result. Nevertheless it was admitted that the beaver and his works are in themselves objects of interest which many summer visitors are willing to go out of their way to see.

Attitude of Local Inhabitants toward the Beaver

Of five local Forest Rangers with whom I discussed the question one expressed himself as in favor of extermination of the beaver, except in a few places where they could do no harm (figure 28) and where they might be allowed to exist for the benefit of tourists and others interested in the animals and their works. The remaining four were in favor of measures of control, providing for reduction of the beaver population where damages caused by them required it, and adequate protection in parts where no serious harm could result. They regarded the fur value of the beaver as a matter of importance to the local inhabitants. One inn-keeper, in a locality where beaver were charged with damage both to timber and to fishing, was emphatically against protection of any sort. Another one believed the beaver to be beneficial to trout and fishing and was opposed to anything like extermination, but was in favor of reduction and control where damages to timber or other interests demanded it. Dr. Van der Veer, whose private grounds had suffered much damage, took a very calm and broad view of the beaver problem. He believed that extermination would be a mistake; that the animals and their works are of interest to visitors in the Adirondacks and that their commercial value as fur bearers is a matter worthy of consideration. In his opinion, likewise, the object to be sought is proper control.

Dr. D. E. Hartnett, of the Rapshaw Fishing Club at Witchopple Lake, stated that the sentiment of his club was against the beaver because they made lakes and ponds unsightly, damaged timber and interfered with trout streams.

Most of my time was spent in the field and consequently few of the local inhabitants were met with. According to the Forest Rangers however, the sentiment of the people of their respective

districts upon the beaver question is divided. Owners of land who are annoyed by the beaver desire an open season and a number are in favor of complete extermination. In localities where little damage has been done the attitude is more or less indifferent, but there is a general feeling that the local inhabitants should be allowed to take beaver for fur where the animals are sufficiently plentiful. One man stated his belief that if many who have complained about damages from beaver were to be permitted to take and sell them for fur from such places there would be little further complaint; that these people were unwilling to have all the trouble and labor of trapping and skinning the beavers only to turn them over to the State to be sold, themselves receiving no compensation.

General Public Interest in the Beaver

As a wild animal the beaver is one of the most interesting on the continent. It offers valuable material to the student of animals in nature, on their behavior, on their relations to the woodland environment and other problems of biological interest and importance. Because of the accessibility of many beaver colonies from conveniently located bases in the Adirondacks, opportunities are open to students interested in such problems without many of the physical inconveniences and hardships often attendant upon these undertakings.

The increasing numbers of summer visitors in the Adirondacks who camp, travel by automobile, canoe, or by the trails, will find their interest and pleasure in the region greatly increased by the presence of the beaver, particularly if they have a general knowledge of the animals so that they can interpret what they see in the woods. When these animals are given proper protection they become relatively tame so that direct observations of their habits are easily made.

Sources and Numbers of Adirondack Beavers

Geographic Races. According to Willoughby ('20, p. 68), a number of the beavers purchased by the State and liberated in the Adirondacks, presumably between 1904 and 1906, "had been part of a Canadian exhibit at the Louisiana Purchase Exposition in St. Louis, Mo." (Cf. also Radford '07, p. 408.) These were undoubtedly of the typical Canadian race, *Castor canadensis canadensis*. But others secured at about the same time came from Wyoming. Dr. Charles C. Adams, Director of the Roosevelt Wild Life Forest

Experiment Station, has kindly sent me the following memorandum in regard to the Wyoming beavers, which he received from Dr. George Bird Grinnell of New York City: "Yellowstone National Park records say: 'Eighteen beaver caught at Yanceys August 14 to September 11, 1907, by T. Elwood (Billy) Hofer and shipped by express to J. S. Whipple, Old Forge, N. Y., for New York State, and four died enroute.' This is taken from Mr. Chester Lindsley's record of animals shipped from the Park. Billy Hofer caught and shipped many other animals." The most complete account of the re-establishment and history of the beaver in the Adirondacks is that by Radford ('07).

According to E. T. Seton ('09, Vol. 1, pp. 448-449) the Wyoming beaver represents a geographic race (*Castor canadensis frondator*), which differs from the Canadian form in being "larger and paler than the type, with scaly part of tail shorter than twice the width." Should permission to take beaver be granted it would be of interest if trappers would save the skulls of the animals and send them to the Roosevelt Wild Life Station in order that material might be available for possible evidence of crossing of the two races.

Estimates of Numbers. I have before stated that estimates of numbers of beavers in any considerable area cannot be made with any great degree of accuracy without much time and careful observation. The results given below represent merely the closest estimates that can be made in the circumstances. They have at least the virtue of being based on certain observed and recorded facts and to that extent are removed from the realm of pure guesswork. The best available index to the beaver population is the number of occupied lodges, and these are the basis for the figures that are to follow.

I shall first refer to the region covered by my own investigations and consider the figures representing the lodges and the dams (in repair) recorded by myself, and having in this connection established the ratio of lodges to dams I shall subsequently use this ratio in making an estimate for Herkimer and Hamilton counties and for the Adirondack region generally, based on the number of dams reported by the District Rangers in 1919 and 1920. The distribution of these dams had been plotted on maps in the office of the Superintendent of Forests at Albany, and these maps were kindly loaned me by Assistant Superintendent W. G. Howard. Lodges had not been reported.

My own maps accompanying this article (maps 1 and 2), were

traced from State land maps given me by Mr. Howard. Many little streams and ponds and other unessential details have been omitted for the sake of clearness. The scale as given on the State maps was two miles to the inch. Reference to these traced maps will show the distribution of the dams and lodges located by myself and also those reported and fairly definitely indicated on my maps by Forest Rangers. The latter will be omitted in the estimates.

The total number of inhabited lodges found was 84, and of dams in repair, 168. Along a number of the streams explored where no lodges are indicated some doubtless escaped notice, but I believe that this number is not large. It is to be noted that the ratio of lodges to dams is 1 to 2.

To arrive at an estimate of the number of beaver here represented we may assume that to each inhabited lodge there were at the time two parent beavers and (on an average) 4 young of the season. We may add to this an average of four yearlings which had not as yet built lodges for themselves and would spend the winter in the parental lodge. This makes a total of 10 beavers to each lodge, and the 84 lodges therefore represent a population of 840 animals. (Cf. Seton, '09, Vol. 1, p. 452.) A certain number of beavers undoubtedly live in bank burrows but judging from the nature of the banks in this territory I believe their number to be small, probably not as great as one-fifth of the number that live in lodges. Assuming, however, that it is a fifth, the bank beavers would number 168. This number added to 840 gives us 1,008 as the number of beavers inhabiting the watercourses explored. If we assume further that the remaining watercourses of these districts which I was unable to visit contained an equal number of beavers, the figure becomes 2,016; or, if there were three times as many, which I believe to be improbable, then we have 3,024.

We may now turn to the figures representing the Rangers' beaver dam reports previously mentioned and see what estimates may be derived from that source. These estimates so far as they concern Herkimer and Hamilton counties may be considered independently of those given above in connection with my own investigations, but it is well to bear in mind that the districts covered by me are included in the area in which, as will be seen later on, the majority of the beaver dams reported by the Rangers are located. My purpose is to arrive at some estimate of the number of beaver in Herkimer and Hamilton counties and in the Adirondack region as a whole, on the

basis of dams reported by the Rangers. It may be accepted that many unreported dams existed, and of course many new dams have been built since 1920, but the fact remains that the Rangers' reports constitute the most complete and definite information we have as to the distribution and the relative density of the beaver population in the Adirondack region generally.

It seems important to mention some points revealed by these reports. With the Forestry Department's maps before me I find that 587 dams for the entire region have been plotted for 1919, and new dams added for 1920 increase the total to 663. Of this number 481 dams are divided between Herkimer and Hamilton counties alone and more than half of these are confined to approximately the northern third of their area. In other words, only a scattering 182 out of the total of 663 dams reported for the whole Adirondack region are located outside of the two counties named, and these counties together contain the great majority of the beaver population. These facts should be noted since it is usually very easy to gain the impression that because a species of animal is plentiful in one part of a region it is equally abundant in all other parts, although such may be far from the truth. And furthermore, such evidence as the Rangers' reports furnish should be given due consideration lest any temptation arise to apply sweepingly drastic measures of control that might properly be applicable only to a part of the region.

Now as to estimates. Accepting the same ratio of lodges to dams as previously given, the same number of beavers to a lodge and the same fraction of bank beavers, it appears that the 481 dams in Herkimer and Hamilton counties represent 2,886 beavers. And proceeding in the same way with the 182 remaining dams scattered throughout the Adirondacks, we shall have 1,092 beavers outside of Herkimer and Hamilton counties. If all the dams reported should constitute only one-half the number that actually exists we have simply to double the sum of the two figures just mentioned, giving an estimated total of 7,956, or in round numbers, 8,000 beavers for the Adirondack region as a whole.

Willoughby ('20a, p. 628) states that the Conservation Commission estimates that there are between 15,000 and 20,000 beaver in the Adirondacks. With regard to natural increase Riley ('21, p. 205) states that: "Likewise, there is very little information about natural losses and rate of increase. Estimates of the numbers in

Long Branch Creek [Rocky Mts.] showed 50 beavers in 1908 and 3,000 in 1918, indicating an average yearly increase for the period of about 50 per cent. This, however, is based only on estimates. In order to be conservative, an annual increase of 25 per cent has been assumed until such time as more accurate information can be obtained." The determination of this normal rate of increase, so important in any rational plan providing for perpetuating the stock and for harvesting annually a fair number of beaver skins, certainly merits additional field study.

Commercial Value and Possibilities

Beaver as Human Food. I have made it a practice to eat the meat of the beavers that I have taken from time to time in Minnesota and in my opinion it is a very palatable food. It was prepared in the same manner as venison. A little care is necessary in skinning the animal so as to avoid tainting the meat with the castoreum. In the words of Seton, "The flesh is good and the tail is considered a delicacy. It tastes like 'calf's head' with marrow dressing." The fat has a delicate and, to my palate, a slightly sweet taste.

Castoreum. The castoreum is a substance produced by a pair of glands in the anal region. It has a peculiar odor which, to me at least, is neither strong nor unpleasant. It is used in the manufacture of perfume, and in medicine it is said to be used as a stimulant and as an antispasmodic. It has been known for over two thousand years and in olden times was considered as more or less of a panacea. Its commercial value at the present time is probably from \$6.00 to \$10.00 a pound, an amount obtainable from about a dozen beavers, when it is in the form of the castoreum glands removed entire and dried. I have weighed two pair of the dried glands and this estimate is based on this fact.

Professor Carl Voegtlin, Professor of Pharmacology, U. S. Public Health Service, Washington, D. C., writes under date of March 30, 1922: "Castoreum has been used years ago as a sedative and antispasmodic for hysteria, but its use for this purpose as for any other it may have had in medicine has been discontinued. There is really no justification for the sale of this drug."

Revenue from Beaver. Beaver is one of our most highly prized furs. As popularly known in coats, collars, muffs and other articles of apparel it consists of only the dense underfur, the long, coarse overhair having been removed by plucking. The part played by

beaver fur in the early history of this country is a very interesting and important one, to which the reader is referred elsewhere (Martin, '92).

The qualities of beaver fur are such that it will continue in the future, as in the past, to command a good price in the markets. It is a natural resource that has important possibilities and is worthy of careful attention. The capacity to harvest a couple of thousand skins or more each year would mean a great deal to the people of the region or to the State itself, and with a fair amount of consideration given to the distribution of the beaver and to local conditions, the Adirondack region should be able to support a sufficiently large beaver population to yield such returns without at the same time incurring an undue amount of damage to timber, fishing or other interests.

In Commissioner George D. Pratt's reports ('20, pp. 48-51; '21, pp. 99-101) he summarizes the damage to timber done by beaver dams in 1919 at \$90.00 per dam. The estimate for 1920 averaged \$22.00 per dam. The total damage for these two years was about \$55,000.00, and this is probably near the maximum damage, as the region is presumably fully stocked.

If, as I have estimated, there are 8,000 beavers in the Adirondacks and if their skins are worth on an average of \$10.00, their total value aggregates \$80,000.00, or at \$25.00 each, \$200,000.00. If an annual harvest of 1,500 pelts were taken each year at \$10.00 each, the revenue would be \$15,000.00; or at \$25.00, \$22,500.00. If 2,000 were taken from the entire Adirondacks at \$10.00 each the income would be \$20,000.00 per year; and at \$25.00 each, \$50,000.00 annually.

A recently received price list quotes average beaver skins as follows: No. 1 extra large, \$33.00; No. 1 large, \$26.00; No. 1 medium, \$17.50; No. 1 small, \$10.00; No. 2 large, \$10.00; No. 2, \$8.00; No. 3, \$3.25; No. 4, \$1.50.

Willoughby ('20, p. 630) states that: "Beaver skins are worth from \$25.00 to \$30.00 each, so it is apparent that the 15,000 or 20,000 busy rodents plying their engineering profession throughout the Adirondacks constitute a half-million-dollar asset, and that the trapping of their annual increase (which is now probably some 3,000 animals) would mean a considerable cash dividend." As has been shown I consider these estimates of the number of beaver too high. Assuming that there are only 8,000 beaver in the Adirondacks, and

allowing 25 per cent as their annual rate of increase, it also seems fair to assume that 2,000 could be killed yearly without diminishing the stock.

But even this does not tell the whole story because there is still another important potential source of revenue to the State. Mr. G. W. Bartlett, Park Superintendent of the Algonquin Provincial Park, Ontario, Canada ('21), states that during the last year covered by his report he received orders for over 100 beavers for shipment to the United States. He states (p. 117) that: "I would therefore recommend that the price of live beaver, * * * be put at \$150.00 a pair. The dealers we have at times supplied in the States charge \$100.00 per animal, and we have been supplying them at \$30.00 each. * * * The price, however, should be at least four times the value of the pelts, as they represent at least that much additional cost. A large quantity of fur has been taken out and sold in Toronto, bringing the nice sum of \$14,179.00."

It would therefore be good policy to use surplus Adirondack beavers for stocking other regions, and if 100 were sold each year at \$100.00 each that would add \$10,000.00 to the \$50,000.00 which can probably be derived from pelts, thus making a total of \$60,000.00 annually.

Such a revenue would thus in one year pay for all the damaged timber, and probably in a few succeeding years for all damages to property of other kinds. It ought even to produce funds for possibly correcting the alleged damage to trout streams and for continuous supervision of such waters.

Recent valuable papers on the methods of cultivating beaver in the National Forests have been written by Mr. Smith Riley, formerly U. S. District Forester at Denver. He says ('21a, p. 200): "The present status of the beaver in the Cochetopa Forest in Colorado is an excellent example of what can be done in the average mountain region suitable for beaver culture. It is estimated that this Forest which covers some 900,000 acres contains 12,000 animals distributed over about half the available water area suitable for production. As the animals were causing damage to ranch property in one locality near the Forest boundary, a plan was drawn up for coöperative trapping with the State game department. It provided for the extermination of the beavers where they were committing actual damage; for their increase unmolested in streams of the Forest not fully stocked; and finally for the transplanting of the beaver to streams

where they do not at present exist, and where food and other conditions are thought favorable for their propagation." (Cf. Riley '21).

It is evident that one valuable use of beavers where harmful or where regions are overstocked would be to transport them to other suitable localities that need stocking, so that the entire Adirondacks could be made as productive as possible of beaver fur.

It is clearly evident that the beaver problem should not be handled hastily and drastically in the supposed interests of a few, when the State as a whole has so much at stake. Further investigations should be made in order to devise the best methods of using this valuable resource to the best advantage.

The possible revenue derivable from the beaver raises the question as to whether or not it is economically wise to attempt to grow timber on lands potentially suitable for beaver, when a fur crop worth over \$50,000.00 per year can be grown on such lands. It will require about 40 years to mature a crop of timber on these lands, and \$50,000.00 annually for 40 years totals \$2,000,000.00.

Summary and Conclusions

In summarizing the results of this preliminary field study I conclude that the chief objection to the beaver in the Adirondacks at the present time is raised in connection with the destruction of timber; their relation to trout fishing; and the flooding of and injury to private lands or grounds, especially along water fronts near cottages and camps.

In some localities considerable damage to timber has resulted from beaver dams, and some difficulties have been caused to logging companies in moving their logs. In other localities the injury to timber has been insignificant and is not likely to increase, because of the character of the streams or their banks, or because there is no timber to damage. While occasionally valuable coniferous trees are affected, the bulk of the timber damaged consists of such soft woods as black spruce and balsam fir, and this is the basis for the main complaints of those interested in pulp wood. Many hardwood trees are often killed; but while they have a potential value they are not generally lumbered in these districts.

Beaver floodings or flows constitute only one of a number of sources of damage to timber, and the total destruction from this agency is not so great as from such factors as either windfall or fire, and is restricted to certain watercourses and the bordering lowland.

Beaver flows undoubtedly have a value as fire-breaks and as such they may on occasion be of assistance in saving from destruction many times the amount of timber that has been damaged or killed by them. As reservoirs and as stabilizers of stream-flow during floods they seem worthy of full consideration, considering the millions of dollars which New York State has spent on canals, and recalling her present extensive program for developing water power.

The relation of the beaver to trout or other fish is not definitely known. Opinions expressed are conflicting and the experiences of different people interested in the subject are often diametrically opposed. It seems probable that, depending upon conditions in a stream, beaver dams at times may be detrimental to trout, at other times, beneficial. There may be a certain point up to which dams on a given stream are beneficial to trout but beyond it, harmful. It is a problem deserving thorough scientific study.

Other topics discussed are the relation of the beaver to tourists and summer visitors, camp or inn owners, scenic beauty, and deer; the recreational and biological interest in beaver; and finally the commercial value of the animals is briefly considered, and an attempt has been made roughly to estimate their numbers.

Beavers constitute a natural resource from which the State or the people of the State should derive a permanent annual income. While the animals may become obnoxious in certain localities, it would seem perfectly feasible to provide specifically for trapping in such places, as the necessity might arise. A number of watercourses along which no damage of importance is likely to result, such for instance as the Beaver River Flow, might be set aside as permanently closed territory. This would safeguard the species against possible extermination and would provide propagation centers for surrounding territory. The Adirondacks are in urgent need of just such wild life sanctuaries. In cut-over or burned-over districts where beaver flows would appear to be desirable as fire-breaks, restrictions might be placed upon trapping. On many trout streams beaver dams for a season or two might be of distinct benefit, and periodic trapping in such cases would prevent the development of injurious conditions. Lakes or ponds, or their outlet streams, so situated that preservation of their wooded shores is particularly desirable might be designated as territory permanently open for taking beaver. The mapping out of streams and other waters where beaver might or might not be taken would seem to offer no very great difficulties. The District

Rangers are thoroughly familiar with their respective areas and if entrusted with this responsibility could doubtless attend to it along with their other duties.

In view of the conditions found and the number of beavers evidently inhabiting the region investigated it appears advisable that the animals be reduced to an extent sufficient to put a check upon such damage as they may be causing in certain localities to timber, possibly to trout fishing, and to private property or other interests within this area. A consideration of all the facts does not appear to warrant drastic reduction in the numbers of the beavers. So far as an estimate of numbers is possible in the circumstances I believe that a reduction of the present beaver population, in the territory in question, to the extent of about a thousand individuals would accomplish the purpose in view. To that end the following recommendations are submitted.

Recommendations

The present investigation has shown that the beaver of the Adirondacks may be made a valuable source of revenue to the State if properly managed. The cost of this supervision is slight compared with the value of the resource. If \$25,000.00 can now be derived annually from Herkimer and Hamilton counties alone, then certainly a few thousands spent on surveys of the whole Adirondack region is a slight expense, and this must precede intelligent management of this resource.

My recommendations are divided into two groups:

Investigations Needed. 1. Surveys similar to the present one should be extended throughout the Adirondacks to determine the present status of the beaver for the region as a whole.

2. A special study should be made of the relation of beaver to trout.

3. The breeding habits need further study in order to determine the *rate of increase*, as this should be an important factor in deciding on the number to be killed during open seasons.

4. Further investigations are needed to determine the *amount of food* (suitable species of trees) *requisite to maintain the beaver*. This will give a basis for estimating the number of beaver which an area can maintain permanently, looking toward a *sustained annual yield of fur*.

5. A study is needed of the local species of aspen and birch in order to know how to secure a sustained yield of beaver food.

Suggested Legislation. Legislation at this time must be largely experimental and provisional because of the following reasons:

1. Defective knowledge of the numbers, rate of increase, and general principles of management.

2. Practical difficulties of controlling the number to be killed.

On account of these difficulties two plans are suggested, with a marked preference for the first.

1. That the officials of the Conservation Commission be authorized to take, not to exceed 1,000 beavers in Herkimer and Hamilton counties, and the pelts or live animals be sold. That the beavers killed, in the main, be taken where they are doing the greatest damage, and when the fur is in the prime, say between December 15 and not later than February 15.

Beaver skins are not really prime until late in the season, and while they remain prime until about May and the animals are more easily trapped when the streams open in the spring, trapping at that time would unquestionably result in the taking of many pregnant females.

It is possible that a toll of 1,000 would be too heavy a drain upon the species, if it were to be taken annually; and the possibility also exists that a greater number could be taken without harmful effect. Since a true estimate of the beaver population is not possible the effect of the first season's trapping should serve as a guide in determining future action.

That pending investigation of the trout problem the Conservation Commission give special attention to particularly valuable trout streams and retard the spread of the beaver on or to such streams.

2. While the most accurate method would be for the Conservation Commission to employ a certain number of experienced State trappers to reduce the number of beavers I believe that in a settled region like that of the Adirondacks the local inhabitants might be justly given consideration. Their good will is also of importance, and the sale of the fur would compensate for damages the beaver may occasionally cause them.

That a short open season, about one month, be declared on beaver in Herkimer and Hamilton counties. That in the first open season the maximum number of beaver to be taken be limited to one thousand individuals, and that the number that any one person may take be limited.

That the open season begin not earlier than December 15, and close not later than February 15.

That the beaver be taken only by trapping and without damage to or destruction of dams or lodges.

That all trappers be licensed and that permits to take beaver be issued only to persons who are *bona fide* residents of the region. A reasonable fee should be charged for the license.

The Conservation Commission should retain power to close the season on beaver whenever in its judgment the welfare of the species may require it.

PART II. THE NATURAL HISTORY OF THE BEAVER

Introduction

In dealing with the beaver problem a general knowledge of their natural history is essential not only for a proper appreciation of their harmful and beneficial influences, but as well for an intelligent interest by those visitors to the Adirondacks who go there for the pleasure of living and tramping in the wild forests. The following account has been prepared to meet this need.

General Remarks on Habits

While the beaver is essentially aquatic it must come ashore for such necessities of life as food and rest. Its short legs and heavy body are ill adapted to ease of travel on land, its gait being slow and clumsy and more in the nature of a shuffle than a walk; its broad tail drags on the ground. Although it lacks neither weight nor strength its only defensive weapons against an adversary on land are its chisel-like incisors and it is handicapped in the use of them in a fight by a well-nigh imperceptible neck and a limited gape. Nevertheless it is quite probable that if hard pressed an adult beaver would be no mean antagonist, for its powerful teeth would crash through both flesh and bone. Mills states ('13, p. 35) that on two occasions he has known beaver to kill a bobcat, but the particulars are not given.

The beaver therefore is naturally ill at ease on land and does not venture any further than necessary from water. When frightened its first and overpowering impulse is to get to its protecting element.

The beaver is usually considered as nocturnal and this is generally true in that most of its major activities are carried on at night. In remote, undisturbed places however, it may often be seen quietly moving about or feeding at almost any hour of the day.

Occasionally solitary individuals may be seen lying, in the daytime, in what I have elsewhere ('21) called "forms," on the shore near the water's edge, apparently merely resting, taking a sun-bath, or dozing. Ranger David Conkey informed me that he also had observed beaver lying thus in the Adirondacks, but I did not happen upon any forms during my stay there.

Senses and Voice. As to the senses of hearing, seeing and smelling, it is probable that, as with the majority of other mammals, the beaver gets most of its information by means of hearing and scent. I am aware of no scientific experiments upon the beaver in captivity to determine the relative rank of the senses mentioned. From my own experiences in the field I am inclined to place the auditory and olfactory senses about on a par as to keenness, and apparently the ones upon which the beaver is most dependent for warning against enemies. But I am also convinced that the eyes are not to be rated as altogether short-sighted or dull where it may obtain an unobstructed view of a moving object. Dugmore ('14, p. 107) speaks of young beaver as being able to see a hawk "even though it appears as a speck in the heavens." With regard to a person or other feared animal, providing it is motionless, the beaver is able to discriminate no better than any other rodent, or most other wild mammals.

The only vocal sounds I have ever personally heard the beaver make were what might be called low murmurs or gruntings by the animals when they were in the lodge. Mills, however, says ('13, pp. 26-27) that beavers have a strange, shrill whistle or call, which seems to be a note of alarm, suspicion or warning; and that a young beaver when alarmed "gives a shrill and frightened cry not unlike that of a lost human child."

Swimming and Diving. In swimming, the propelling organs are the hind feet. The flat tail serves principally as a rudder and is capable of being tilted from the horizontal to an angle of probably forty-five degrees or more. It is possible that it may at times be used as a scull but I have personally never seen it thus employed. When swimming straight away the beaver strikes out with both feet simultaneously, but when turning, the strokes may alternate, one being more vigorous than the other, and the tail assists. I have many times observed beaver in captivity use their feet and tail in this manner and on at least two exceptionally favorable occasions in the wilds. The fore feet are not used in swimming but are held against the sides of the body.

Often when scratching himself or performing his toilet the beaver draws his tail forward between his hind legs and sits upon the upper or dorsal surface of it.

The beaver is an expert diver. When alarmed he goes under with a loud slap against the water with his broad tail, followed by a "kaplunk" of the disappearing body. At other times he may stealthily sink beneath the surface without a sound.

Seton mentions an instance where he observed a beaver that swam under the surface for about a quarter of a mile. A specimen which I once took in a trap, dove, and after it had been under probably half a minute I took out my watch to time it. At the end of 5 minutes and 10 seconds I began to fear that the beaver had escaped and, poking around with a stick to see if it was still there, after a few seconds located the beaver under the bank; when I poked it, it came to the surface. It had been under water altogether about six minutes and no doubt would have remained under longer had I not disturbed it.

Instinct and Intelligence. Popularly the beaver is sometimes credited with intelligence bordering closely upon the human kind. I do not know of any experiments made with the beaver to determine whether its intelligence is above or below that of any other species of rodent, but its brain is smooth like that of other rodents, and it is probable that the beaver so far as mentality is concerned cannot boast of any great superiority over the rabbit, the squirrel or the rat. But in the course of the ages it has evolved a set of instincts, highly complex, at which we cannot but marvel just as we marvel at the instincts of the ant and of the bee. These instincts are inherited and at the right time in their life history, when the proper stimuli prompt them, the young beaver will do certain things, and do them in the same way and just as well as their parents, without first having to be shown or taught how. The works of the beaver usually appear to be so well adapted to a purpose that we sometimes are tempted to believe that the animal must have been conscious of the effect of each step in the process and that the whole had been carefully planned out beforehand. But we experience much the same feeling when we consider the ways of the ants and the bees.

Sociability and Wandering. The beavers are highly sociable animals and this characteristic finds expression not only in the works of the colony but also in their indulgence at times in play,

which, according to Morgan, takes place both on the shore where they bask about or in the water where a number of them may swim about, ducking each other.

In the summer months many beavers roam about more or less, frequently to considerable distances from their home locality. Whether this is indulged in by all members in a colony or only by the males, unmated individuals and young of the preceding year, is not certain. It does not seem probable that females with young of the season would make any extended excursions away from the home lodge. At any rate, in Minnesota, Colorado and in the Adirondacks I have found lodges occupied by adults all through the summer, and in some cases there were young of the season also.

Breeding Habits

So far as known the beaver pairs for life. According to Seton ('09, Vol. I, p. 471) the animals mate in February and the young are born in May, the period of gestation being accordingly about three months, or fourteen weeks according to Dugmore. While Seton's statements refer evidently to the beaver of Manitoba, the mating season no doubt is about the same for the Adirondacks. Persons whom I questioned in the Adirondacks could give me no positive information on these points but seemed to believe that the young were born during May or early June.

The young are born in the lodge or in a bank burrow and vary from two to six in number, or possibly there may be as many as seven or eight in some cases, the average being probably four. The young at birth are said to be fully furred, with their eyes open, and are able to leave the lodge with the mother when three weeks or a month old. At this age they are also said to begin eating solid food. They remain with the parents for a year or longer and are not sexually mature until two years old. In the autumn following their birth, that is, when they are three to four months old, they will take part in building dams and lodges. Young beavers separated from their parents at an early age will build lodges and dams without first having "learned" to do such things from their parents, the building habit being instinctive.

The mother beaver is said by some naturalists to exhibit considerable concern for her young when they are in danger and will come to their defense. It is not definitely known whether the male takes any active part in the care of the young. Evidence seems

to show that he either voluntarily leaves the lodge or is driven away by the female at about the time the young are born and leads a more or less solitary life in the vicinity, or perhaps associates with young of the previous year and with other males that may be in his neighborhood.

The length of a beaver's life is not definitely known, except probably for such as have been raised in captivity. Seton says ('09, Vol. I, p. 472) that they live from 12 to 15 years. Enos Mills ('13, p. 193) mentions a beaver which he had glimpses of "through eighteen years, and he must have been not less than four years of age when I first met him."

Enemies of the Beaver

Aside from man the principal enemies of the beaver are considered to be wolves and foxes, bears, the lynx and the wildcat, fishers and otters; and among birds, the great horned owls and the goshawks. In the north where the wolverine occurs, this animal is also said to be an enemy. In the Adirondacks the most common natural enemies are probably foxes, great horned owls and goshawks, but the toll taken by these is of course probably limited wholly to young beavers pounced upon from time to time when they are ashore. I found one little beaver in the Adirondacks which appeared to have met its end in this way.

The muskrat is by some persons considered an enemy of the beaver because of the mischief it occasionally does by tunneling through the beaver dams.

Food and Feeding Habits

Food. In food habits the beaver is vegetarian. Where the aspen or poplar occurs its bark is eaten to a greater extent than that of any other tree. The various kinds of bark fed upon have been mentioned in the first part of this report. In the summer months the beaver undoubtedly feeds also upon a great variety of tender grasses and sedges, buds and young leaves, as well as roots or rhizomes of water lilies, flags and other plants growing about water or in the water; probably also ground-growing berries.

About the middle of August the beaver begins to prepare for the winter by laying in a supply of freshly cut boughs which are stored usually in the water by the lodge. When the pond is frozen over the animals may then dive beneath the ice from their lodge.

gnaw off a branch and return to the lodge to feed. Through the summer months the feeding grounds may be easily recognized by the little heaps of peeled sticks found in shallow water along the shore. In such places, partly submerged and partly concealed by overhanging bushes, the animal sits quietly nibbling off the bark from the twigs as they are held in the forepaws.

Cuttings. Trees are cut down primarily to secure food; secondarily the cuttings are used in the construction of lodges and dams, but many boughs are cut and added to the dam, especially, without first being stripped of their bark.

In the majority of cases, when there is no snow, a tree is cut at a height between twelve and eighteen or twenty inches from the ground. The gnawing may be made entirely from one side, or, as in the case with most of the larger trees, all around the trunk. The literature contains records of trees 3 feet in diameter that have been felled by beavers. The largest I happened upon in the Adirondacks was an aspen 17.5 inches in diameter.

Most cuttings are made within easy reach of the water but at times the animals must go farther afield for their food supply. In the Long Lake district a number of fresh cuttings were found which had been dragged about one hundred yards, as paced, to the water.

In dragging the cuttings conspicuous trails are formed. Figure 29 shows where such a trail has been cut through the crest of a bank about a hundred feet above the water along Cold River. Smaller boughs are seized at the butt, the rest of the branch trailing behind as the beaver moves forward; while in the case of heavier poles the animal probably is forced to move backward as he drags them. According to Seton, "Small logs are rolled by one or more beavers pushing with their hands, their shoulders, their hips or their whole broadsides."

The trees cut by the beaver fall in whichever direction they happen to lean or as the wind or mere chance directs. Most trees near the water lean that way. Numerous examples of poor judgment and wasted efforts in tree-felling may be found in the woods about many beaver ponds. Trees standing on the side of a hill may have a spiral twist to the cut, brought about as the beaver moves from a higher level to a lower, or vice versa, cutting around the trunk. Each of the two cuts in the birch shown in figure 30 has a definite spiral turn.

The time required by a beaver to fell a tree of given size is not positively known, for only rarely has the operation been actually observed and recorded. Seton says, "Two beavers can cut down a three-inch sapling in three minutes and a six-inch tree in an hour or two. Three are the most that have been seen working on the same tree at once." Their work, however, is often erratic and subject to many interruptions; many partly cut and abandoned trees may be found in most beaver-inhabited localities (figure 31).

Photographs by Dugmore ('14) and Shiras ('21) show that the beaver stands erect upon its hind feet, supported by the tail, and rests its fore feet upon the trunk when gnawing off a tree.

Trees up to about four inches in diameter are usually cut into sections of various lengths and dragged to the ponds; in the case of larger trees only the branches are removed.

The amount of food eaten by a beaver in a year is not known. We ought to know how much an average colony or lodge needs in order to know the potential productive capacity of a given area of forest for beaver. Aspens (Weigle and Frothingham, '11, pp. 16-17) and paper birch (Dana, '09, pp. 19, 36) grow rapidly and yellow birch more slowly (McCarthy and Belyea, '20, pp. 19, 42, 49). It probably requires from 10 to 20 years for the aspens and paper birches to become three or four inches in diameter at the level where the beaver cuts them, and of a size to attract it.

Beaver Architecture

Character of Ponds and Streams Favored. It is a familiar fact that beavers usually choose for their dam building operations small, shallow streams with sluggish current. Running water seems to be the stimulus that sets the dam-building instincts in motion. During dry periods when the water in creeks forms only a series of interrupted pools of still water, damming operations usually cease. A pond that has no stream entering or leaving it but is fed by seepage from springs, and drains off by underground channels, suffers no damage from dams, except occasionally indirectly from neighboring sources. Streams whose water averages more than about 2.5 or 3 feet in depth are rarely dammed, although if shallow rapids occur much deeper streams may be dammed at such places. The width of a stream alone does not easily discourage the beaver and even a swift current is often overcome by anchoring the dam against various obstacles that may be found in the stream.

Uses and Construction of Beaver Dams. The dam provides the animals with a sufficient depth of water to insure safety from their enemies and to provide transportation facilities as well as safe storage places for their winter food supply. Since the entrances to the lodges must be rendered secure it is important to maintain a sufficiently high water level to cover them. The water being too deep to freeze to the bottom in winter, the beaver is enabled to move about under the ice and secure his food with the utmost safety.

The materials used in building dams are usually green boughs, dry sticks, poles, roots, mud and sand, and occasionally stones (figure 32) are added. When logs are found as part of a beaver dam they have either drifted down or were there before the dam was started, the dam probably being built against them in some cases. The lower side of the dam usually contains exposed sticks and boughs which are arranged generally parallel with the flow, and the upper side is covered with mud, muck and entangling rootlets. Old dams become more or less grass-grown. The length of the dam is very variable and is governed largely by the character of the banks and the duration of the colony in the locality. In some parts of the country old dams have been found measuring thousands of feet in length, the work of many generations of beavers. In the Adirondacks the longest dam which I encountered was about 375 feet in length.

Beaver dams require constant attention by the animals. Water is constantly trickling through or over them, and when neglected they soon disintegrate.

The height of dams varies within much narrower limits than the length but is governed largely by the same factors. The two highest dams that I saw in the Adirondacks measured 8 feet, 8 inches and 11 feet, 1 inch, respectively, from the bottom of the creek at the main channel to the crest of the dam (figures 33, 34). While the dams are usually substantial and tenacious affairs, easily supporting the weight of a man and even of larger animals, they at times have their weak spots and give way before the volume of water above them. The literature on the beaver contains statements to the effect that they sometimes make openings in their dams in times of heavy rains or floods in order to relieve the pressure on the dams. Personally I have never seen any clear evidence of this.

Dams may be straight, curved upstream or downstream, zig-zag or any other form that the situation and circumstances, accident or

the vagaries of the animals themselves may determine. There is no reason to suppose that the beaver selects the site of the dam with conscious intent or a knowledge of what the effect will be if it is placed here or there.

Canals. In some situations the beaver digs canals of varying length which probably serve mainly for transportation purposes. Where beaver ponds are bordered by open meadow land the tendency to construct canals seems to be most often displayed. Possibly the animal's reluctance to go overland is partly responsible for the habit. The canal gives it not only easier means of transportation but greater security in passing back and forth from its foraging grounds. The canals vary from a foot to a yard or more in width, ten inches to two or three feet in depth and from a few yards to four or five hundred feet in length. The earth is dug out with the fore feet and deposited on the banks, and not infrequently the evenness and uniformity of the whole gives it the appearance of having been done by human hands. Some canals that I have seen in stony, unsuitable ground were so narrow that they must have greatly increased rather than diminished the difficulty of transporting boughs. Channels are often dug in shallow ponds in order to secure sufficient depth of water for freedom of movement and transportation. Such channels of course are not usually in evidence except where the water level has fallen, when the bottom of the pond may be seen to be traversed by them in various directions.

The Lodge or House. The home of the beaver is either a den at the end of a burrow in the bank, or a "house" or lodge (figure 35, 36). The lodge is similar to that of the muskrat but is made of sticks instead of reeds or grasses. There are as a rule two entrances to the lodge and they are under water. In the fall of the year the beaver often brings up mud from the bottom of the pond and daubs it upon the outside of the lodge in more or less haphazard fashion. With additions from time to time a lodge may after a few years become pretty well plastered all over with mud. From my personal observations I should say that as a general rule the beaver adds at least some mud here and there on the lodge, but I have never seen any uniform application of it all over the structure during any one season. One lodge which I happened upon in the Adirondacks had just been started and had a number of daubs of fresh mud in among the freshly cut boughs of which it was being built.

The interior of a beaver lodge is a more or less dome-shaped

chamber with the floor three or four inches above water level. It is said that sometimes there may be a litter of grass on the floor, or shredded wood; at other times there may be no litter of any kind. The size of the chamber is variable, from two or three feet to five or six feet and, in exceptionally large lodges, it has been said to be as much as 20 feet in diameter. The height of the ceiling may be from one and a half to two and a half feet. In the great majority of cases there is only a single chamber; when more occur it is believed that they represent separate but contiguous lodges. Like the dam, the lodge constantly grows by sporadic additions to the outside, of peeled sticks, poles and mud, so that in the course of a few years a lodge may attain large dimensions. Of the two largest lodges that I happened upon in the Adirondacks one measured 32 feet in its longest diameter, 29.5 feet in the shortest, and was 6 feet, 7 inches high; the other was 35 feet and 28 feet in longest and shortest diameters, respectively, and 7 feet in height.

As a rule a lodge is occupied by a single family of beavers, which may include the young also of the year before. At times a lodge may be occupied only by a single individual; and an exceptionally large one may, according to some writers, have as many as fifteen or twenty occupants.

Beavers that live in holes in the bank are often spoken of as "bank beavers" but, contrary to popular notions, they are not a different variety of beaver; in other situations they would build lodges.

While the lodge furnishes a safe retreat in which to rest and rear their young, the beavers invariably leave it at the approach of an intruder and seek safety in the water.

Classification and Description

The beaver is the largest of North American Rodentia or gnawing mammals. It is assigned to the genus *Castor* of the family Castoridae. This genus contains the only living representatives of the family, namely, the North American beaver, *Castor canadensis*, and the European beaver, *Castor fiber*. The American beaver is represented in different sections of the country by a number of geographic races or subspecies. These races are, according to Seton, the type form *Castor canadensis canadensis*, whose range includes the greater part of Canada and approximately the northern half of the United States; *C.c. carolinensis*, of the southeastern states; *C.c.*

texensis, limited almost wholly to Texas; *C.c. frondator*, of the mountain region of the western and southwestern states; *C.c. pacificus*, of the Pacific Coast region of the United States, Alaska and Canada. More recently, Mr. Vernon Bailey has described three new subspecies, *michiganensis*, *missouriensis*, and *mexicanus* from specimens from Michigan, the upper Missouri River in North Dakota and from New Mexico, respectively.

A giant slightly beaver-like rodent, of the genus *Castoroides*, at one time occurred in North America. Judged by its fossil remains this animal is believed to have been about the size of a black bear. Its skull was in form strikingly like that of the present day beaver.

The American beaver is a thickset, heavy-bodied animal, very similar to the muskrat in general form of body. Its color is reddish brown above and a paler grayish hue below. The tail averages about 15 or 16 inches in length. Its basal third, approximately, is hairy and abruptly demarcated from the remaining part which is conspicuously scaly, broad and paddle-like, being flattened in the dorso-ventral direction instead of from side to side as in the muskrat. The legs are short, and the hind feet are large, the five toes being connected by broad webs, giving them a striking similarity to the feet of a goose or swan. The second toe has a peculiar "split nail" the function of which is not perfectly clear, although it is believed by some to be used in removing parasites from the fur. The fore feet are also five-toed but relatively small. They are supplied with rather long claws adapted for digging. The ears and the eyes are small, the color of the latter black. The nostrils can be closed when the animal is under water. The front surface of the upper and lower incisors or cutting teeth is of a deep orange color.

Outwardly the sexes cannot be told apart except by the more conspicuous mammae in the female.

The weight of full-grown specimens may vary from 30 to 60 pounds or possibly more.

Historical

Dr. C. Hart Merriam ('86, p. 253) says: "That the beaver was once abundant in all parts of the Adirondacks is attested by the numerous remains and effects of their dams; but at present they are so exceedingly rare that few people know that they still exist here." Farther on the same author quotes DeKay, writing in 1841, with reference to the same general region covered by the present investigation (pp. 254-255): "In the summer of 1840, we traversed

those almost interminable forests on the highlands separating the sources of the Hudson and the St. Lawrence, and included in Hamilton, Herkimer, and a part of Essex counties. In the course of our journey we saw several *beaver signs*, as they are termed by the hunters. The beaver has been so much harassed in this State, that it has ceased making dams and contents itself with making large excavations in the banks of streams. Within the past year (1841) they have been seen on Indian and Cedar Rivers, and at Pas-kungameh or Tupper's Lake; and although they are not numerous, yet they are still found in scattered families in the northern part of Hamilton, the southern part of St. Lawrence and the western part of Essex counties." Says Merriam, "At present [that is, in 1886], there is a small colony of beavers on a stream that empties into the West Branch of the St. Regis River. It is probably the colony referred to by DeKay, in 1842, as 'yet existing in the southern part of Franklin County.'"

In 1895, it was estimated by H. V. Radford ('07, p. 417) that there could not have been more than about five or ten beavers in the whole Adirondack region.

Some Erroneous Popular Beliefs. Among the erroneous ideas more or less current is the notion that the beaver begins his dam by felling trees across the stream and that the dam is built out of logs.

While the shape of the tail is suggestive of a trowel it is not used as such; nor is it used as a raft for transportation of mud or other things. Mud is carried in the forepaws which have developed hand-like skill and functions.

It is no more possible for a beaver to suck air out of branches and poles thus causing them to sink, than it is for a human being to do so. Green wood is nearly as heavy as water and after being immersed a short time will sink of its own accord. Dry wood likewise becomes water-logged and submerges but takes longer. The beaver makes the sticks or branches stay down at first by partly covering them with mud or by anchoring them among stones or debris on the bottom.

Beavers have no means for driving poles into the ground and have never been known to do so.

The beaver does not catch or eat fish. One person in the Adirondacks told me of having seen a photograph of a beaver that had a fish in its mouth. If not actually intended as a joke such a photograph represents merely an amateurish attempt at nature-faking.

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THE LIFE OF THE YELLOWSTONE BEAVER*

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Why Study Beavers, and Where?

If I were to judge from my experience at Camp Roosevelt, in the northeastern part of the Yellowstone National Park, during the past summer, no animal except the bear arouses so much interest on the part of the park visitors as the beaver. Within fifteen minutes' walk from the camp, near the bridge over the Yellowstone River, and close beside the Cooke City road, is a fine series of small beaver ponds (figure 37). Hardly an evening passed during the summer but anywhere from half a dozen to thirty people thought it well worth while to walk down there and spend an hour or more watching these fascinating animals, which are obliging enough to go about their usual activities almost oblivious to the interested observers lined up upon the bank beside the road. Here one can observe not only the

* This preliminary account of the Yellowstone beaver is the first of a series of papers on the wild life of the Yellowstone National Park which have been made possible by gifts to this Memorial Station from joint friends of Theodore Roosevelt and of wild life conservation. The initial aid for this plan came from Mr. Howard H. Hays, President of the Yellowstone Park Camps Company. These studies were made with the approval of Hon. Stephen T. Mather, Director of the National Parks Service, and with the approval and hearty cooperation of Mr. Horace M. Albright, Superintendent of the Yellowstone National Park, and of Mr. M. P. Skinner, Park Naturalist. Mr. Warren, a very competent field naturalist, contributed his services, and he was aided by his volunteer assistant, Mr. Ellis L. Spackman, Jr. I gladly avail myself of this opportunity, on behalf of the Roosevelt Wild Life Station, to thank these men most heartily for their very substantial and generous contributions.—The Director.

ponds, dams, lodges and all stages of felled trees and stumps, but even the beavers themselves swimming about in the water, crawling over the dams, cutting aspen branches, and busily and audibly eating the bark. If one is careful, by refraining from making quick movements and unusual sounds, so as not to disturb the animals, the opportunities for observation are excellent. Indeed, there are few places in America, even in remote regions, where such opportunities are equalled.

The park visitors asked me many questions regarding the beaver, and the following account answers some of these questions of general interest about them as well as summarizes the results of my own studies conducted in the vicinity of this Camp and at Yanceys, where in 1897 and again in 1912, Mr. Ernest Thompson Seton conducted observations which were published in his books "Wild Animals at Home" and "Life Histories of Northern Animals."

The region is a very favorable one for beavers and contains several colonies of special interest. Each of the colonies was surveyed and mapped, to show the relation of the various ponds to one another. The dams were measured, and notes taken as to their construction; and as far as possible the lodges were studied, although most of them were inaccessible, and I did not feel justified in breaking into any of those which I could reach. I measured many stumps to find their height; many more were examined to see on which side they had been cut; and notes were taken as to the direction in which a tree had fallen, with reference to the deepest cut. Evenings were spent in watching the animals themselves and gleaning what information I could as to their ways. In short, an attempt was made to secure as much information as possible concerning the life history of the animals.

In my work about Camp Roosevelt during the summer of 1921 I examined no less than eight areas of beaver ponds and dams, as follows:

- (1) Beside the Cooke City road, near the Yellowstone River bridge;
- (2) South Fork of Elk Creek, from the Petrified Tree to Yanceys;
- (3) North Fork of Elk Creek, and bench between the forks, west of Yanceys;
- (4) Near Crescent Hill;
- (5) Along Tower Creek, about two miles above Tower Fall;
- (6) Lost Creek, above the Fall;
- (7) Lost Lake, on the plateau above Camp Roosevelt;
- (8) The Yancey Meadows.



Fig. 37. The series of ponds beside Cooke City road near Camp Roosevelt, Yellowstone National Park. Taken from slope of Junction Butte above Yellowstone River bridge, showing location of ponds, large aspen grove on hillside, and the grove destroyed along the stream.

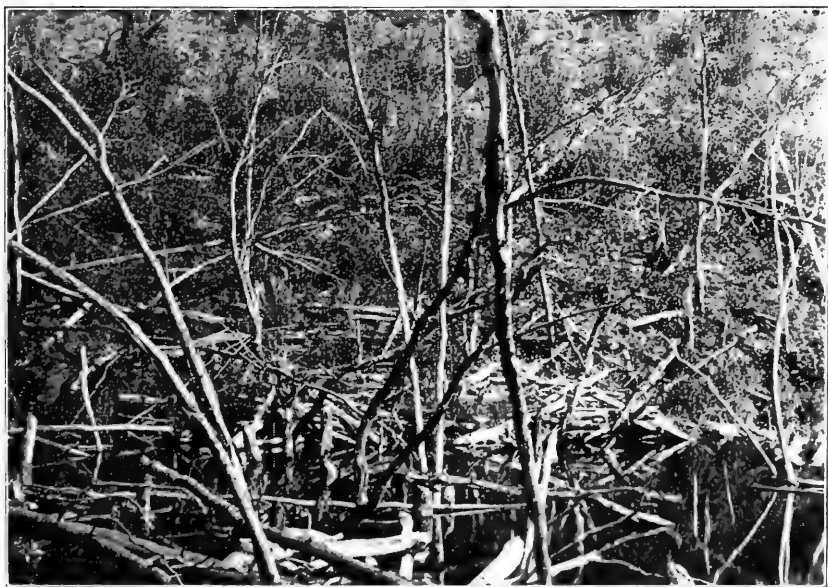


Fig. 38. Pond No. 2 beside Cooke City road, showing log-piles protecting the entrances to burrows. These log-piles may in time become lodges.



Fig. 39. The lower beaver trail leading across the Cooke City road from the pond to the aspen grove above. Taken from north hillside above the pond.



Fig. 40. North Fork of Elk Creek, near Yanceys. The long dam photographed from hillside above the easterly end.

These localities, together with a number of smaller ponds near by, harbor many colonies of beaver and represent a great variety of conditions. They are all easily accessible to the tourist by either roads or trails.

Colony near Yellowstone Bridge. The group of ponds paralleling the Cooke City road, near the Yellowstone Bridge (figure 37) is the one which visitors to Camp Roosevelt are most likely to see. If they do not make a special visit to the ponds they are almost sure to pass them on the way to the Yellowstone or Lamar rivers on fishing trips. Therefore a somewhat detailed account of them may not be out of place here. Mr. M. P. Skinner, the Park Naturalist, informs me that there were no beaver at this place ten years ago, so that all the work here has been done within that period of time. Here is a steep, narrow gulch, with a small stream of water, and formerly densely set with aspens, along which have been constructed about twenty dams of various lengths, making a series of ponds which form a continuous waterway for several hundred feet. There are two lodges, and in one pond beaver were living in burrows whose entrances were protected by log-piles (figure 38). In this pond there were at least three beavers, an adult and two yearlings. Quite possibly there may also have been another adult. In one of the lodges were 2 adults, 3 yearlings, and 3 of the season's youngsters.

A question often asked is: Why do the beavers have so many ponds? There are several reasons for this. In the first place, these ponds were most probably not all built at once, but successively, those lowest downstream first. As the green aspens growing in the gulch and on the hillside were cut down and used for food, the animals had to move upstream to get nearer the food supply and so more dams were built. A beaver always prefers to travel in the water when it can; it is too much at the mercy of its enemies when on land, and also it can float sticks along a pond to the dam, drag them over the next to the pond below, and thus take them wherever desired. As practically all the green aspens in this gulch near the water as well as on the adjoining hillside are now cut, there is but little available food unless the animals go some distance above the uppermost ponds, where the space is too narrow and the slope too steep to make sizable pools. They do appear, however, to be working that way. Their other alternative is to go across the road to the large grove on the hillside above, and opposite the ponds (figure 39). They have cut down some trees there, but it is a dangerous

place as they are exposed to attack while going to and fro. It was reported to me that one beaver had been killed there this season by some animal. This large grove should afford a supply of food for some years to come. I am interested to see what will be the outcome there, so I have marked the stumps of the trees cut by beaver, over 300 in all, by pounding the end of a half-inch iron pipe into them, making a circular mark in the wood. This will enable a future observer to identify the new cuttings.

Another use of a series of ponds is the protection which they give one another in times of high water. A dam backs water up against the dam above, strengthening it and helping it to resist increased pressures, while the ponds and dams still farther above, by holding back the flood water, distribute it more evenly and relieve the ponds below. To man, beaver ponds are useful in conserving the water supply, retaining much of the rain and snow which would otherwise pass off at once and go to waste.

South Fork of Elk Creek. A mile from Camp Roosevelt along the main highway, a road branches off to the Petrified Tree. Along this road one is immediately interested by the series of beaver ponds and the belt of tall dead timber in the ravine below. A fine forest sweeps up the slope beyond. The dead timber was killed by flooding as the result of a series of beaver dams built along the small stream in recent years. The area was practically abandoned after the beavers had used up all the aspens nearly to the head of the ravine. They are still at work intermittently on the few remaining large aspens in the swale opposite the Petrified Tree; but little or no effort is made to keep in repair the works below. The ravine is a tangle of silty ponds and grass-grown dams, through which many sluices and channels drain the water. Apparently the beavers use it chiefly as a highway now.

Lower down on the South Fork, in the forest just above the Yancey cabins, is a newer series of ponds and dams; but the same process of flooding the spruce flat and using up the aspen is going on steadily, and by and by the occupants will have to seek new homes. Whether the colony there migrated from the upper part of the stream or from some other locality is an interesting question.

North Fork of Elk Creek. Other groups of ponds which at least some of the visitors see, are those on the North Fork of Elk Creek, to the west of Yanceys, and on the high flat between the North and South Forks. In the former group is a very long dam, 350 feet in

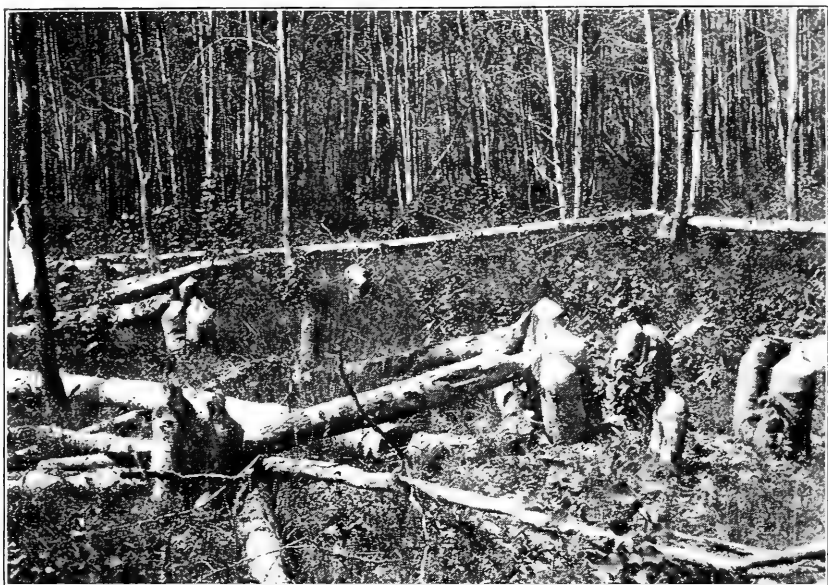


Fig. 41. Freshly cut aspen logs, near pond on bench above Yanceys, August 10, 1921. These trees are about 6 to 10 inches in diameter.

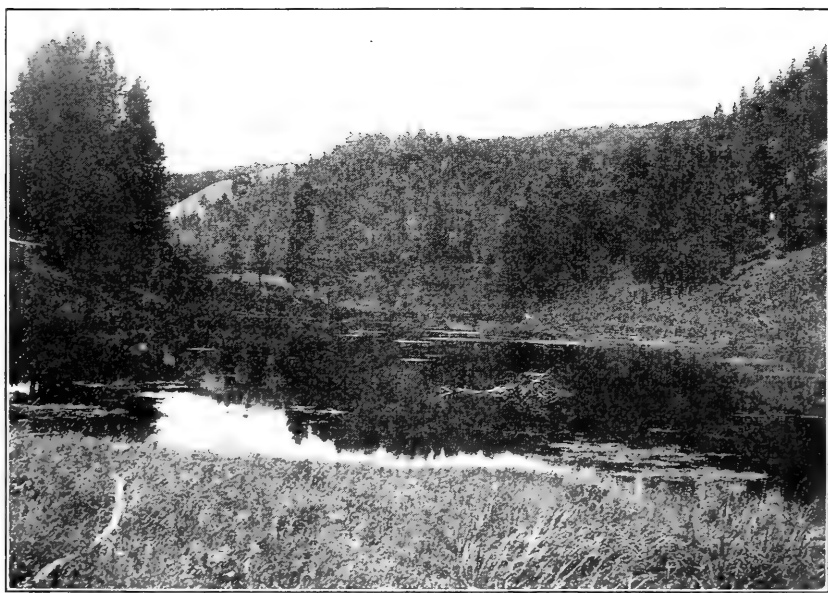


Fig. 42. The large pond at Crescent Hill; view from the upper end, showing beaver lodge and fringe of dead aspen.



Fig. 43. The long dam adjacent to Tower Creek; 275 feet long. In dense Engelmann spruce timber, now killed by flooding.



Fig. 44. Beaver trail on hillside above large pond. From the end of the long dam adjacent to Tower Creek (figure 43).

length (figure 40). In spite of the great length of dam the pond is not much more than 100 feet wide. It contains a medium-sized, typically shaped lodge. Below this dam is another, the pond belonging to which is nearly filled up with silt, and much of it grown up to grass and willows,—a good example on a small scale of the making of a beaver meadow. And below this dam, strung along the creek for nearly half a mile, are no less than thirteen very old dams. Some of those farthest down the stream are being partially rebuilt and new ponds are forming.

Above the large dam is another 250 feet in length. The pond originally formed by this has been drained by a tunnel through the dam at the level of the water in the pond below. Above this is the unusual occurrence of a double series of ponds and dams. The easterly one, of five ponds, takes its water from flat, swampy ground. The westerly group of nine, a series of small ponds, is on the stream itself.

On the high flat between the North and South Forks is a small stream along whose narrow gulley the beavers have long since destroyed all the aspen nearly to its source, their disintegrating dams now alone remaining. This little stream is fed by cold springs in a dense old Engelmann spruce woods, along whose margin are fine mature groves of aspen. The beavers have now dammed the brooklet clear to the borders of the spruce bog, and a very interesting point to notice here is that the evaporation from the large pond seems to nearly balance the inflow, so that no water flows over the dam. If the flow of water into the pond does increase, from heavy rains for instance, the beavers at once build up the dam a bit higher, utilizing every drop of water. This largest pond contains two lodges. Many aspens have been freshly cut in a fine grove close along the shore (figure 41). In the marshy ground above, several small ponds have been dug out and dams built of mud during the past season, as well as more typical dams. In one of these ponds a small lodge was constructed between August 10 and September 4, and aspen brush stored beside it.

Beaver Ponds near Crescent Hill. These are located in the beautiful region at the very head of the North Fork of Elk Creek, easily reached on horseback or on foot. The largest of the ponds (figure 42), at the foot of the Crescent Hill cliffs, lies in a perfect setting of forested hills and open grassy valleys. Most of the nearby aspen has been cut, but the beavers keep the dam in fair repair, so

as to maintain a water highway at least, and forage farther and farther away. Over the divide from this pond is another large one, without visible outlet or inlet, where much fresh felling of aspen is going on. The trail to the lower Yellowstone River traverses the shores of this attractive pond.

The Tower Creek Works. Two miles above Tower Fall, and adjacent to the Creek, are some fine beaver works well worth a visit by anyone interested in the subject. Here is a dam 275 feet long (figure 43) making a good sized pond, which contains a dense grove of large spruce killed by flooding. This pond is on the first flat or terrace above the creek, and receives its water supply from a very large spring a short distance above. Between this pond and the spring are many small ponds, and there are more below the large dam. Doubtless when the winter snows are melting and Tower Creek is high, it overflows this flat and floods these ponds. There is a giant beaver lodge in the midst of the heavily timbered flat (figure 61).

The fact that all of the works here are on a large scale makes them of especial interest. The narrow and very deep ravine running nearly east and west, resulting in very different types of forest on the north and south slopes, has had the effect of confining the beaver cuttings to the broad aspen slope of southern exposure. Therefore the beaver runways, slides and canals are especially marked and elaborate there. Figure 44 shows one of the steep and wellworn slides down which the beavers drag their loads of aspen from the open groves above, to the nearest corner of the big pond (indicated in figure 43).

On Carnelian Creek, tributary to Tower Creek, a pretty bit of engineering work was found. At a bend of the stream was a portion of an old dam, extending perhaps half way across. A low extension had been added to it, carrying it enough farther along to deflect part of the water onto the level bank of the stream, which was quite low at this place (figure 60). This water supplied a series of three sizable ponds on the flat, the lowermost of which was several feet above the creek level at that point.

Lost Creek, Above the Fall. On the plateau above Camp Roosevelt the beavers are very active, and their dams in all stages of construction and disintegration indicate many years of habitation there. There are three ponds now in use, one of these containing three houses (figure 45); and some distance above is a newer group of



Fig. 45. Pond on Lost Creek with three lodges; also showing steep hillside with aspen stumps, denuded to the edge of the lodgepole pine forest, 175 feet from the pond.

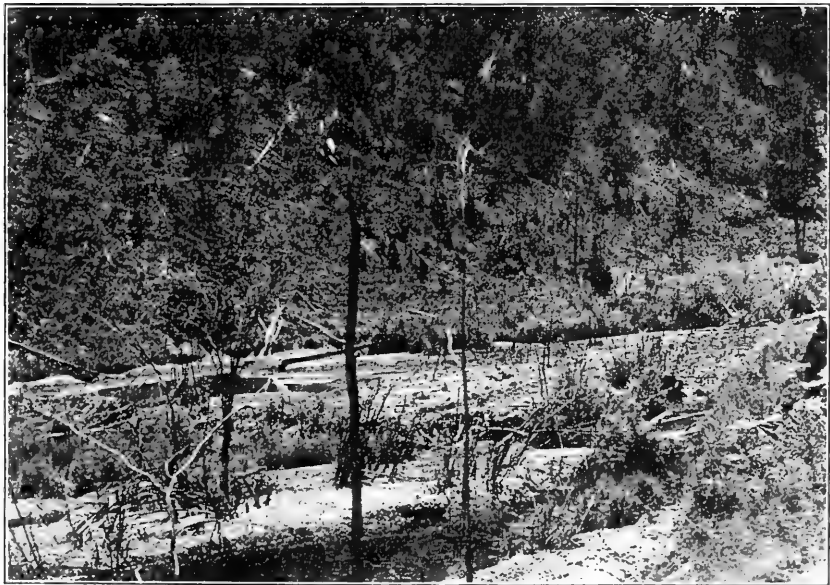


Fig. 46. Pond No. 14 on Lost Creek, showing gravel washed in. Illustrating how an abandoned pond may become filled with silt and debris.



Fig. 47. Lost Lake, near Camp Roosevelt. A party of naturalists and boys from the Forest and Trail Camp on a beaver study excursion.



Fig. 48. Upper beaver meadows on Lost Creek, above Yanceys, showing old dam. These were large ponds when Ernest Thompson Seton studied them in 1897.

four small ponds. Figure 45 shows how high and steep a slope the beaver will denude of its aspen growth; and figure 46 tells the story of the silting up of beaver ponds as a result of spring freshets and summer thunder storms.

One wonders at first how the beavers, clumsy enough on land, ever reached the upper creek waters, for the high Lost Creek Fall drops sheer into a deep gorge hemmed in by perpendicular cliffs. But the creatures find their way to the plateau by other drainage lines, doubtless from Elk Creek on the north and the headwaters of some branches of Tower Creek on the south.

Lost Lake. This is an exquisite little lake (figure 47) amid the hills on the heights back of Camp Roosevelt, and readily reached by a steep footpath through the lodgepole pine forest. It is long and narrow, with both ends grown up to thick grass and the margins dense with luxuriant yellow water lilies. Its shores pitch sharply to considerable depths, soundings of 48 feet being obtained in it. It is a spring-fed ravine lake, raised somewhat by the old, low beaver dam near its rock-rim outlet at the margin of the plateau. There is one lodge there, and beavers were noted many times swimming about in the daytime. This is the happy result of its long seclusion, and the animals will always be unafraid so long as people take care not to disturb them. The roots of the water lilies would appear to be about the only readily available food there at the present time, although a few aspens have been recently cut a short distance back from the outlet, but nevertheless quite a long way from the open water and the lodge. There was a channel through the marsh grass to the dam; and this and other signs indicated that the lake is a way station between the Elk Creek and Lost Creek works.

The Yancey Meadows. The final result of the filling up of such a pond is a beaver meadow, and one cannot find a better example of this than the one near the old Yancey place (figure 48), where hay is now extensively cut and stacked for the winter feed of elk and buffalo, and the Rangers' horses; and where bands of antelope haunt the margins of the broad lowland. Yet no longer ago than 1897 there were ponds here occupied by an active colony of beavers. Seton gives ('09, pp. 455-472) a very full description of them, with a sketch map. About 1903 or 1904 the beavers abandoned the place, very possibly because they had exhausted the available supply of aspen, and it gradually changed to its present condition. I examined the stream for traces of the old dams, and though I found some of

them, in most cases they had decayed and settled down to the level of the surrounding surface, showing that a comparatively short period of time is necessary to form a meadow. Farther down on the South Fork of Elk Creek, below Yanceys, are old dams which were broken through by high water twenty-five years ago.

Description of Beaver. As muskrats often inhabit beaver ponds, Park visitors unfamiliar with either animal should bear in mind that the adult beaver is much larger than the muskrat. In appearance a beaver is somewhat like a big, overgrown muskrat, with a broad, flat, scaly tail. Even the brown color of the fur is not at all unlike a muskrat's. The total length of an adult beaver is about 42 inches, of which 16 inches is the tail,—the black, scaly portion being about 9 inches long and 4 inches wide. It will weigh 35 pounds and upward, even reaching 60 or more, although that is unusual. The hind feet are broad and webbed and the second toe has a curiously split nail. This latter is said to be used for combing the hair, but I do not know of anyone who has seen it so used. The forepaws are small, and the animal uses them much as hands, holding sticks when gnawing the bark from them, and also using them for digging up bottom mud and sod which are carried to any desired spot for building purposes, holding the material with the paws against the chin.

The fur is of two kinds,—the close, dense undercoat, and the long, outer guard hairs. These latter are usually plucked out in preparing the fur for the trade.

The huge incisors or front teeth are the tools with which the beaver does his wood cutting, and are eminently adapted to the purpose (figure 49). These teeth on the front side are composed mainly of a thin edge of very hard enamel, with a broad layer behind of relatively soft dentine. As the tooth is used the softer dentine wears away much faster than the enamel, so that there is always a sharp chisel edge on the front of the tooth. These teeth grow continuously during the life of the animal, and if by any accident one is broken or so injured that it does not oppose the one in the opposite jaw, the latter may grow out to such an extent as to seriously inconvenience the animal, if not to cause its death from inability to feed. The incisors are long, and the hidden portions have much curvature within the skull and lower jaw. Morgan gives the radius of the curvature of the upper incisors as one inch, and of the lower, one and three-quarters inches. The front of the incisors is deep orange

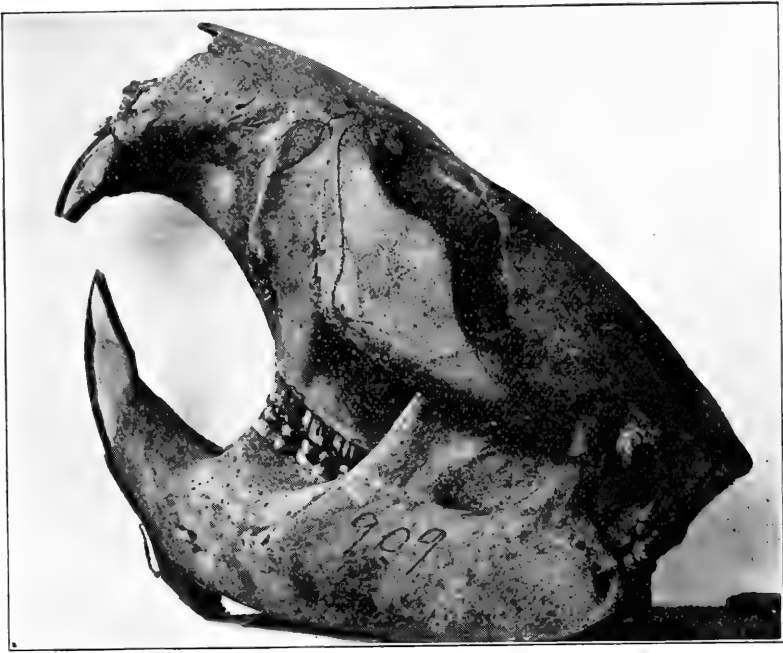


Fig. 49. Side view of skull of a beaver, showing the chisel-like character of the front teeth.

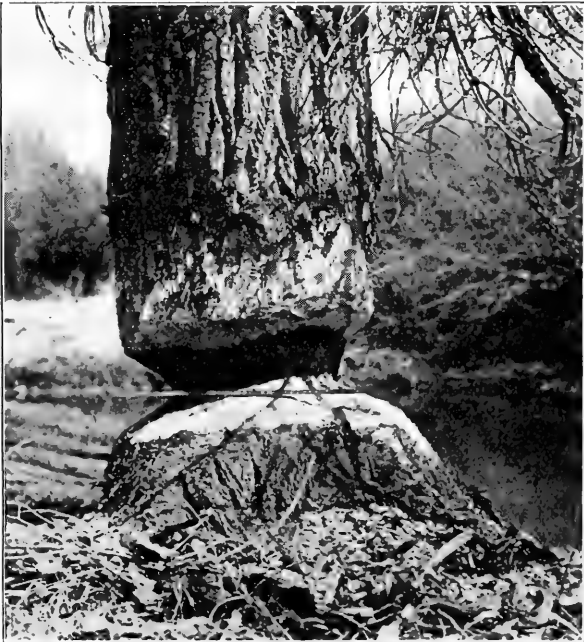


Fig. 50. Cottonwood tree partly cut by a beaver. The rule in the cut is 2 feet long. Trinchera Estate, Costilla County, Colorado, May 11, 1913.



Fig. 51. Large aspen partly cut by beaver. The tree measured 4.6 feet in circumference above the notch. Photographed July 22, 1921.



Fig. 52. The large aspen after it had been felled. Photographed September 4, 1921. It was still standing August 28. The rule on the stump is six inches long.

in color. There are four teeth in the molar series on either side of each jaw, formed on much the same principle as the incisors, of vertical layers of enamel and dentine, the unequal wear of which gives a good grinding surface.

Food of the Beaver

The food of the beaver consists largely of the bark of deciduous trees, of which, in the Yellowstone and other parts of the west, aspen is the favorite. Willows and alders are also used, but not the bark of conifers, except occasionally. In summer other plants are also used; and I have noticed that they seemed especially fond of wild rose bushes. The beavers would go up on the hillside, near the Cooke City road, at Camp Roosevelt, and gather great bunches of these, holding them in their mouths and trailing them along down to the water. They sometimes ate them there by the bank, and sometimes they would swim with them to the lodge, diving and carrying them inside. Cow parsnip, choke cherry and various others of the plants growing along the shores of the ponds were also eaten. At Crescent Hill, near Yanceys, we saw beaver trails leading through the grass to where many thistles had been nipped off close to the ground. I saw grass carried to the lodge on several occasions, but there is a possibility that it might have been used for bedding.

One often sees in popular articles the statement that a beaver cuts a tree so as to make it fall in any desired direction. This is not true, as the animal makes the cut where most convenient to himself, and lets the tree fall as it may. On a steep hillside, and with trees up to six inches in diameter, in a great majority of cases the cut will be made on the uphill side, or on one side or the other, rarely on the downhill side, and all the cutting will be done from one side. From the way the cuts are made, one might suppose the trees would fall uphill, or to one side, but nearly all of them fall downhill, because they naturally lean that way.

When the trees are growing on level ground it is a different matter. They are usually cut quite evenly all round, especially if the tree is a large one. This is well illustrated in the case of the cottonwood in figure 50. A beaver may start to cut a tree, and then stop work; returning some time later to finish the job. This was finely illustrated in the case of a large aspen on the North Fork of Elk Creek, beyond Yanceys (figure 51). This was first seen July 20, and then had a considerable notch in it, not very freshly cut, but

done recently. The tree was seen from time to time and on August 28 was still standing, but on September 4 was found to have been felled (figure 52). The tree measured 4.6 feet in circumference above the notch when standing.

Why does a beaver occasionally cut a tree and leave it where it has fallen, unused? Frankly, I do not know. I have in mind a lodgepole pine, about 4 feet in circumference, which we found on Tower Creek by the large spring, about two miles above Tower Fall. Beaver had cut it, and there it lay untouched. Across the stump lay another conifer which they had also cut, and likewise had not used. It looks almost like wanton waste. The big lodgepole pine was difficult cutting, being of harder wood, and the chips beside it were much smaller than those cut from aspens. I have found some of the latter nearly seven inches long, while the largest pine chips were about four inches long.

The height of stumps varies, ordinarily ranging from 6 to 20 inches. I found a few from 2 to 3 inches high, and a group of half a dozen from 3 to 4 feet high. One curious thing about these last is that the trunks were lying there unused. They appear to have been cut when deep snow was on the ground. In Colorado I have found the beaver active in the snow, as shown in figures 53 and 54.

The largest stump cut by a beaver, of which I have personal knowledge, is a cottonwood in the Colorado Museum of Natural History, at Denver, which is 2 feet, 5.5 inches in diameter, and came from the Platte River above Denver. Director J. D. Figgins writes me that there is evidence of long intervals between the periods of cutting on this stump. Enos Mills mentions one stump of 3 feet, 6 inches in diameter, on the Jefferson River, Montana, near the mouth of Pipestone Creek.

Some measurements were made with the idea of ascertaining how far a beaver will go from water to cut a tree, but the results were rather inconclusive. At Crescent Lake old stumps were found 220 feet from the water's edge, but there were no trees farther away, and there seem to have been none formerly. This was the greatest distance found. At Lost Creek they foraged 175 feet away from the ponds, in this case to the limit of the aspens and the beginning of the pines (figure 45).

As cold weather approaches the beaver begins to make provision for the winter; so that besides seeing that the dam is in good order,

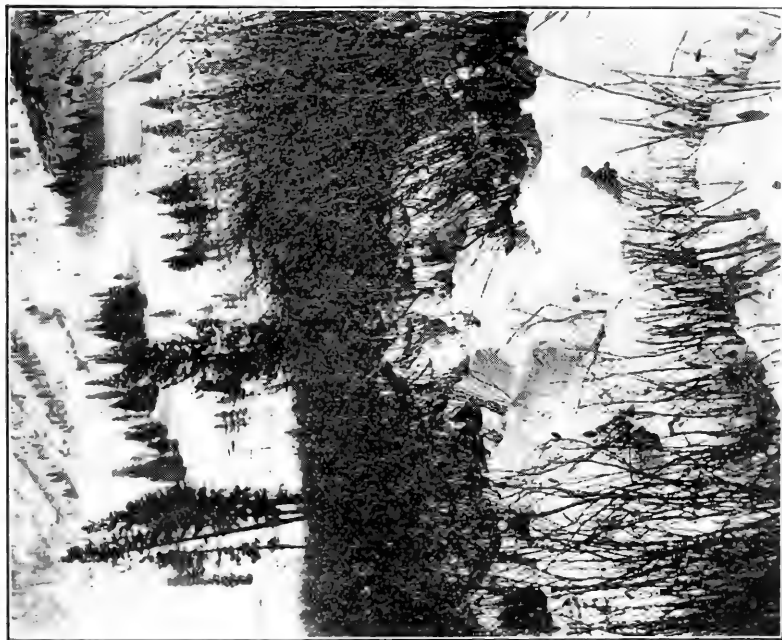


Fig. 53. Beaver house and trails in snow. Near Slate River, 2.5 miles above Crested Butte, Gunnison County, Colorado, October 20, 1905.



Fig. 54. Beaver trail in snow. Near Slate River, above Crested Butte, Gunnison County, Colorado, October 20, 1905.

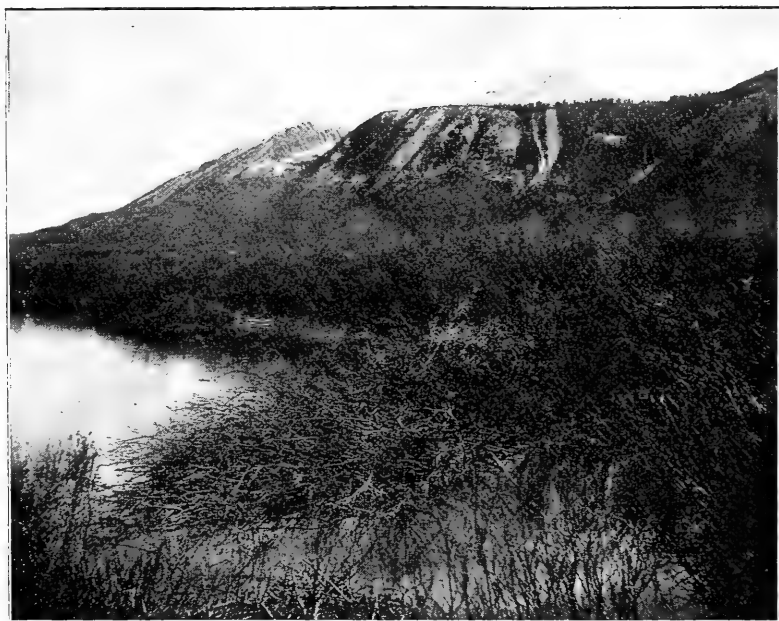


Fig. 55. Willow brush in beaver pond, cut and stored by beaver. Near Crested Butte, Colorado.

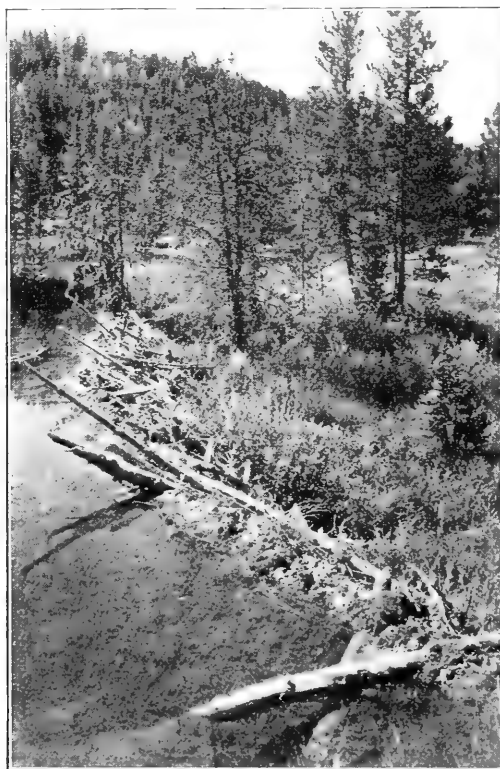


Fig. 56. A beaver dam near Brush Creek, Gunnison County, Colorado, showing pine logs projecting above the dam. An unusual occurrence.

and the house well plastered with mud, it also begins to lay in a stock of provisions, in the shape of logs and branches of trees upon whose bark it feeds. Where aspens are available, these are the preferred sort, and willows and alders are likewise used, but the alders seem to be third choice. Where they are found, maple and birch are also made use of, and are much liked. Whatever species are used, the wood is taken to the pond and stored in the water. The small logs or poles are carried to the bottom and forced into the mud sufficiently to hold them until more is piled on them. While green aspen does not sink, as I have seen stated in a recent popular article on the beaver, but floats, it is very heavy, and doubtless after a time becomes waterlogged, though one often sees freshly peeled green sticks floating in the pond where they have been discarded.

These food piles are usually at the lodge or close by. When the pond is covered with ice the owner comes out under water, cuts off a length and carries it indoors, where the bark is eaten, the peeled stick being carried out and left in the water. In Colorado I found a mass of stored willow brush extending 100 feet along the shore, in water four feet deep, and piled up to the surface (figure 55). These willows were from three to eight feet long, and it will readily be seen that they represent much work as well as a large amount of food.

Beaver Engineering

Dams. Beavers use four different types of construction: dams, lodges, burrows and canals; but not every beaver uses them all, many living only in burrows, and probably are as well or better off for that. This happens when they are living on a stream too deep or swift for dams or lodges.

A dam is begun by laying twigs and branches on the bottom, butt ends upstream, and very likely forced into the bottom. These are covered with gravel or mud dug from the upstream side, stones also often being used. More twigs are then laid on top and covered, and thus the dam is built up until its top appears above the surface and a pond begins to form. The dam is carried up to the required height and the top is plastered with mud. The builders keep close watch on it, and are continually making repairs and additions. A beaver dam is never finished while the pond is occupied, its owners continually adding something to it. Perhaps the water may flow around the end. That is stopped with mud or sticks, whereupon the water in the pond rises so that the main dam has to be added in order to

hold it, and then more water goes out around the ends and the process is repeated. I have but little doubt that many of the long, crooked dams which we see were thus built, not by design but by this continual effort to stop the leaking over and around the dams.

Not all dams are built in streams. Some are built across gulches or on the sides of the valley, to control the water from springs. The largest pond I examined near Camp Roosevelt lies between Crescent Hill and a low ridge to the east (figure 42). It is 800 feet long by 340 feet wide, and is controlled by a comparatively short dam 165 feet long. This pond is supplied by springs, no surface water flowing into it except in the spring of the year when the snow is melting. There is quite a series of dams and small ponds below the large one, and several hundred feet downstream is a new dam which in time may make a fair sized pond, for the builders have selected the most suitable site, where the rather wide valley narrows somewhat, making it possible for a comparatively short dam to back up considerable water.

Also on Tower Creek, about two miles above Tower Falls, is an extensive series of ponds deriving their water supply from a very large spring on the flat ground scarcely one hundred feet from the stream and but a few feet above its level. A low dam had been built across the lower side of the spring, which is now about fifty feet in diameter, and measures eight feet deep.

Let us return to the building of the dam. On the lower face are placed many sticks, often those from which the bark has been eaten, or willow branches are used, and I have seen quite good sized logs utilized, whose ends projected high above the dam (figure 56). Whatever the material, these sticks are generally placed up and down the face, not transversely (figure 57). There is invariably, I think, a trail over the dam where the beavers cross, and this is always where the stream is, so that they may go down into the water from above.

It seems to me likely that in beginning a dam some of the branches are customarily laid across the current, for I have seen a number of dams which appear to have been thus underpinned. Moreover, when a dam is cut through, whether by man or by natural agencies, there are always the ends of sticks showing in the cross section thus exposed, indicating that they are deliberately laid crosswise (figure 58).

Dams are not always built completely across the stream. I recall a series of three dams in Colorado, none of which extended all the



Fig. 57. Dam in which willow brush was largely used in construction, and with which the face is covered. A good example of this type. Monument Creek, El Paso, Colorado.

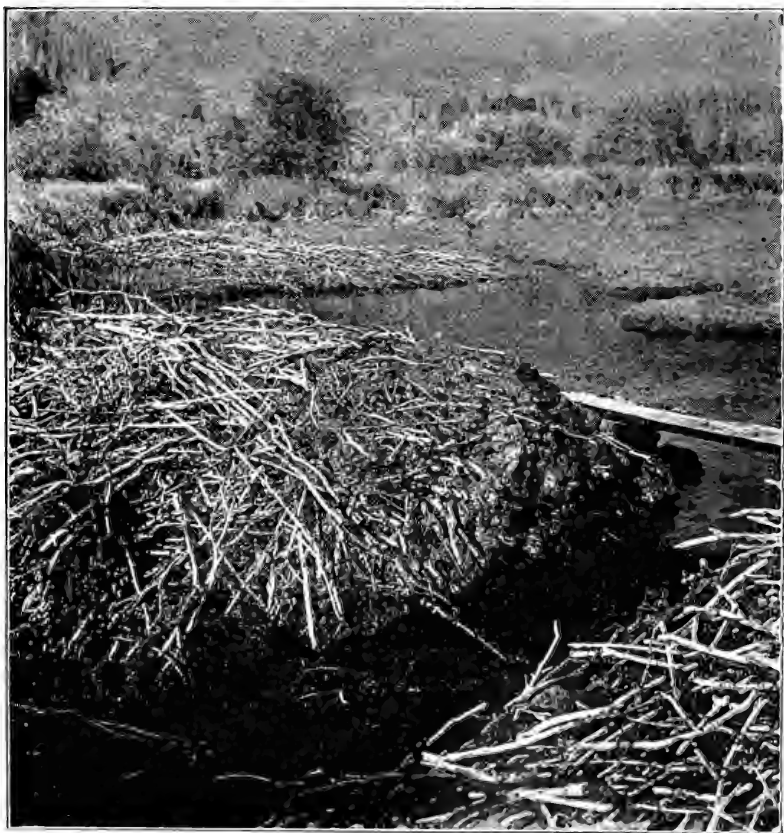


Fig. 58. Section of beaver dam, showing underpinning of sticks laid crosswise to the current. Near Crested Butte, Colorado.

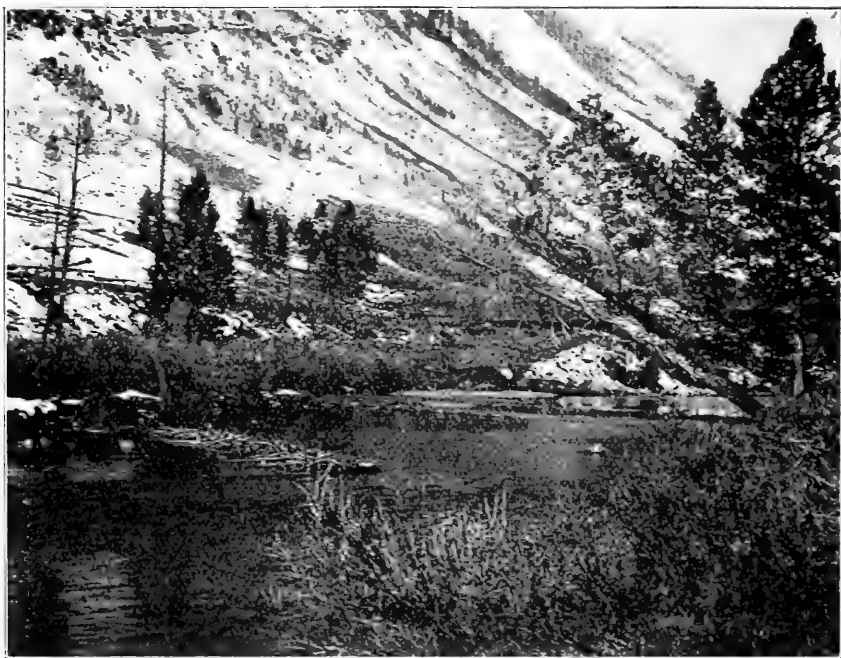


Fig. 59. Series of three beaver dams placed so as to form deep, quiet pools by the bank of the stream; on Slate River, Gunnison County, Colorado.



Fig. 60. Diversion dam on Canelian Creek, turning part of the stream onto the bank to supply ponds there.

way across the river (figure 59). One of these was on one side, the other two on the other, and they were placed in such a manner as to deflect the water first to one side, then back again, forming deep, quiet pools. The diversion dam on Carnelian Creek, already described (p. 196), also illustrates this method of building (figure 60).

As to the length of dams, they vary from a foot or two up to several hundred feet in length. The longest I measured was 350 feet long, on the North Fork of Elk Creek (figure 40). Seton speaks of one near Obsidian Cliff which he thought was 400 yards long. Enos Mills mentions one near Three Forks, Montana, 2,140 feet long, mostly old, more than one-half of which was less than 6 feet high, two short sections being 23 feet wide at the base, 5 at the top and 14 high. Dams vary in height as in length, but I think they are rarely more than 6 feet high on the lower face, usually less. The thickness of the base varies firstly with the height, and secondly with the age of the dam, for as the material settles with age it tends to spread; and silt also settles at the base, so that even if the structure does not increase in height it may become wider.

If a dam is abandoned it gradually goes to ruin, yet many of the dams in Yellowstone Park and elsewhere have probably been abandoned at times for a number of years, and then repaired and reoccupied by a new colony of beavers.

Lodges. Lodges may be divided into two sorts, those built out in the water away from shore, and bank lodges. The former must have a foundation of some sort to start with, as a small island, or an elevation of the pond bottom sufficient for a beginning. Seemingly the lodge begins with a burrow, covered with mud and sod, on which sticks are laid, much as in building a dam. The interior is kept hollowed out as the work progresses, and the structure is more loosely built above the chamber to permit of ventilation. The floor is a few inches above water level, and is furnished with a bed of grass or shredded wood fiber. Dugmore says there are two levels to the floor, the lower for drying and feeding, the upper for a bed. There are usually at least two entrances to a house. In size they range from 8 feet to 10 feet in diameter and up. The largest house I have ever seen and measured is one in the large pond on Tower Creek previously mentioned (figure 61). It is 21 by 24 feet in diameter, and 7 feet 3 inches above the water level. Five entrances were found. Dugmore mentions a house in Newfoundland

that was 37 feet in its greatest diameter. An old house in a drained pond in Colorado, which I opened for examination, was 8 feet wide across the section, and 10 feet the other way (figure 62). The chamber was 2 feet wide, and extended back 4.5 feet. It was a foot high, but I suspect that the roof had settled. It was furnished with a bed of swamp grass. Dugmore gives the dimensions of one chamber as follows: 4 feet 10 inches long, four feet five inches wide, 2 feet 1 inch high, lower floor 4 inches above water, bed floor 6 inches higher.

Bank lodges are of two kinds, probably with intermediate stages between them. One sort is built against the bank, or with at least part of the structure projecting into the water, really a burrow extended and roofed over. The other kind is wholly within the bank, connected with the water by a burrow, and is simply a burrow enlarged and covered. A new one and an old one of this latter type were seen on Carnelian Creek. The former (figure 63) was 4 feet back from the stream bank, 15 inches above ground level, and 3 feet in diameter. An example of the first kind may be seen near Camp Roosevelt, below the Cooke City road, and the one in a pond a little lower down (figure 64) may possibly belong here. This last is the one which was occupied by a family of beavers in the summer of 1921.

Burrows. Besides a lodge a beaver colony always has one or more burrows in the banks of a pond as additional refuges. One of these on the North Fork of Elk Creek was 31 feet long, which is probably unusual, the majority no doubt being much shorter. One sometimes sees piles of logs and sticks in the water over the entrances to holes. These may in time develop into lodges. In Tower Creek I concluded that beaver were living in a log jam where there was a mass of débris high enough and solid enough to afford shelter for one or more of the animals, and no other place was found where they might be living. Also at another place on the same stream there was beside the bank a somewhat confused mass of sticks and logs which likewise appeared to be used as a dwelling. The creatures are undoubtedly very adaptable in their choice of dwelling places.

Canals. I am somewhat disposed to the belief that in some respects the canal is a higher engineering achievement than the dam. To deliberately plan and dig a channel in which to float logs to a pond, and not only that, but also to build dams in this channel to hold the water to a desired level, is an intelligent act. This is what



Fig. 61. The big lodge adjacent to Tower Creek, in midst of heavy Engelmann spruce forest. Diameter 24 feet; height 7 feet, 3 inches above the water.



Fig. 62. Beaver house cut open, showing chamber and entrance. Near Crested Butte, Gunnison County, Colorado, September 5, 1902.



Fig. 63. Bank lodge on Carnelian Creek. Doubtless during high water in spring this would be flooded and untenable.



Fig. 64. Lodge in one of the ponds along Cooke City road. An example of a house lodge built against the bank. Occupied by at least eight beavers.

the animals do, however, when the trees are at a distance from the shore, and the ground is flat enough to permit of carrying water in on a level, or controlling it by miniature dams. These ditches vary in width from 1 to 4 feet, in depth from 8 inches to 2 feet, and the length may be but a few feet or very much more. Morgan mentions two in Michigan 523 and 579 feet long respectively. There is one on Tower Creek 90 feet long, and another 150 feet. Where the slope of the ground is such that the water would not maintain its level in the canal, a small dam is built to hold it back. Thus one of the Tower Creek canals was 17 feet long at the pond level from the shore to the lower end of the dam, and 23 feet to the upper side of the dam, and above this was another section of ditch 64 feet long (figure 65). The lower level of course obtained its water from the pond and was 15 inches deep (figure 66). The upper level was 9 inches deep and was supplied by drainage from the marshy ground about it. The canal was from 15 to 18 inches wide. The difference in level between the two parts was 20 inches. The long, gradual slope of the lower face of the dam facilitated dragging logs over it.

The other canal on Tower Creek was about half a mile up the creek from the preceding (figure 67). It was connected with the stream by a trail 23 feet long, and at the time of the examination this was 2 feet above the water level. This canal was from 3 to 4 feet wide, and 12 to 18 inches deep. The westerly bank was considerably lower than the other, and was being raised by mud dug from the bottom. The water supply was apparently derived from a spring at the landward end.

Life History, Other Habits, and Enemies

The number of young in a litter is from two to five, three or four being probably most common. They are born during May. I have not been able to learn at what time they first make their appearance outside the home nest; but most writers state that they appear in a very few weeks. At Camp Roosevelt I was sure there must be a family in the lodge in one of the ponds on the Cooke City road. There were two adults (figures 69, 70) and three yearlings seen almost every evening, but no smaller animals. I looked for them on my frequent visits, but it was not until August 22 that the young were seen, three, as large as big muskrats. Having a close look at one, I estimated its length as eighteen inches, while the yearlings

were 30 inches or less. It is possible, of course, that these young were not allowed out of the lodge when people were about. They were certainly well able to take care of themselves when they did appear.

The beaver we watched were quite playful at times, at least the yearlings; and I also saw the kits play together once, but I spoiled the little game with the noise of a graflex shutter, and it ceased suddenly with a great splash. The game seemed to be to push each other about in the water. This appeared to be by placing cheeks and shoulders together, and pushing, and perhaps pulling, for they may have been holding with the forepaws. In any event two once rolled clear over in the water without losing their grip. My assistant said they made a noise like a young kitten, only sharper. Others have likened the voice of a beaver to that of a young puppy.

A beaver is undoubtedly at home in the water, even though its gait on land is a very awkward waddle. The hind feet alone are used in swimming, the tail not at all, except at times as a rudder. It is remarkable how quietly they can submerge and swim under water. One afternoon at the group of ponds by the Cooke City road a beaver was in shallow water eating some willow twigs it had cut. I was attempting to get into a position where I could get a picture, and was standing on some poles over the water. My movements disturbed the animal and it disappeared; but after an interval I saw it floating on the other side, watching me. To get to this place it had to pass under the poles on which I stood, and yet I had seen no indication of the passage. It went back and forth several times, always without detection.

During the summer a fishing party saw a beaver swim the Yellowstone in the canyon about half a mile below Elk Creek. It was working upstream and crossed several times. Whenever it came to very swift or rough water it dove and swam under water, coming to the surface again in a smooth place. It landed so close to a boy in the party that he laid a fishing rod over its back.

Beavers have a habit of occasionally making little piles of mud, round and flattened, and depositing their castoreum on them. This seems to serve in some way as a means of communication with other beavers. I found one such on upper Lost Creek when making my examination of that group of dams (figure 68). It was quite fresh when found, and must have been made one or two nights preceding, for we had been there just previously. It was a trifle more than a foot in diameter, and about four inches thick.



Fig. 65. Upper water level on two-level dam, at works adjacent to Tower Creek. The dam is under the log in the foreground.



Fig. 66. Lower water level connecting with pond, and earth slide or chute from dam. On two-level canal at works adjacent to Tower Creek.



Fig. 67. Canal and mud banks half a mile above group of ponds at the big spring by Tower Creek.



Fig. 68. Mud "sign heap" in upper Lost Creek; about a foot in diameter and four inches thick. The beavers deposit their castoreum on these piles, perhaps as a means of communication.

Castoreum is a secretion found in two glands situated in the pubic region. It has a mild odor which appears to be attractive to other animals besides beaver. It is used as a bait in trapping the beavers themselves, a little of it being placed in such a position that the animal in coming to it is caught in the trap. It was formerly used as a medicine, still has a market value, and is a regular article of trade with the fur buyers under the name of "beaver castors."

Beavers have a number of enemies which never hesitate to pounce upon them whenever they get the chance. When the animal is on land its awkward gait makes it a comparatively easy prey to such predatory animals as mountain lions, bears, wolves, coyotes, or wolverines. Otters are also said to attack them. If that is the case, otters must be dreaded foes, for they are as much at home in the water as the beavers themselves.

Value of Beaver to the Park Visitor

The value of the beaver to the Park visitor is something rather difficult to put into words, but the creature has a real fascination for the intelligent tourist. Here is an animal of most interesting habits which was once to be found over the greater part of the United States but has since been exterminated from large areas, yet has left traces of its former presence in such place names as Beaver Brook, Creek, Kill, River, Lake, Falls, Hill, Dam and Meadow. It can still be found in abundance in many parts of Yellowstone Park and the surrounding National Forests, affording opportunity for observing its habits and studying its works. Surely this is a valuable privilege for all who can visit the great Park.

It is worth while to observe in its native haunts a creature, whose fur has been an object of pursuit from the earliest days of North American settlement, and the search for which marked the beginning of the exploration and settlement of much of our western country, and which is still to be found undisturbed and free from molestation by the trapper.

Many a meadow in the thickly settled east was once a beaver pond. In the Park sanctuary the visitor from those regions may see meadows which only a few short years ago were ponds inhabited by colonies of beavers, but which are now yielding hay for the support of larger animals. Certainly an animal in which the great majority of tourists are interested is of value both to them and to the Park. The visitor can learn much about beaver ways without the trouble



Fig. 69. Beaver swimming. Photographed at the large pond at Crescent Hill; about noon, July 22, 1921.



Fig. 70. Beaver crossing a dam. Photographed from beside the Cooke City road near Yellowstone River bridge in mid-afternoon.

of long excursions into the wilderness,— how they fell trees for food and habitation, their marvelous engineering skill in damming streams and constructing lodges, their family life, and their relation to their surroundings. It is worth while to know these interesting facts at first hand rather than solely from pictures and books.

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WILD LIFE AND DEMOCRACY

"Above all, the people, as a whole, should keep steadily in mind the fact that the preservation of both game and lesser wild life—by wise general laws, by the prohibition of the commercialism which destroys whole species for the profit of a few individuals, and by the creation of national reserves for wild life—is essentially a democratic movement. It is a movement in the interest of the average citizen, and especially in the interest of the man of small means. Wealthy men can keep private game preserves and private parks in which they can see all kinds of strange and beautiful creatures; but the ordinary men and women, and especially those of small means, can enjoy the loveliness and the wonder of nature, and can revel in the sight of beautiful birds, only on terms that will permit their fellow-citizens the like enjoyment. In other words, the people as a whole through the government, must protect wild life, if the people as a whole are to enjoy it. This applies to game also."

THEODORE ROOSEVELT and EDMUND HELLER.

Life Histories of African Game Animals.

Vol. I, pp. 155-156, 1914.

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CURRENT STATION NOTES

Viscount James Bryce

In the death of Viscount Bryce, America has lost a friend whose sympathetic understanding of our democratic institutions and high ideals of statesmanship have won for him the affection of the American people. At this period of reconstruction when such leadership as he gave for a generation is so much needed to extend international good will, the loss of the "world's greatest Liberal" is especially felt.

When invited to become a member of the Honorary Advisory Council of the Roosevelt Station he responded in characteristic manner:

"I cordially appreciate your invitation to become a member of the Honorary Council proposed to be created, and as I assume that membership thereof does not involve active duties, which of course my residence in England would not permit me to discharge, I have much pleasure in accepting the honor." He further adds that he is in "hearty sympathy with the work described [in publications] and with every plan for preserving wild life and the untouched aspects of Nature. Theodore Roosevelt did admirable work in that line, and I rejoice to learn that the impetus is not declining."

He became a member of the Council April 29, 1921, and he died on January 22, 1922, and was thus a member for less than a year, but his moral support did the cause much good and that good will be lasting. His interest in our National Parks led him to write, at the time that he accepted membership on the Council: "Knowing well the Yellowstone National Park, I am very glad to hear of the observations to be carried out there. My address in England is Hindleap, Forest Row, Sussex, where I observe wild life to the best of my opportunities." His interest in nature was shown many years ago by his writing at the age of 21, "The Flora of the Island of Arran," and his long interest in angling, mountain climbing and in our National Parks, are only the varied expressions of this appreciative interest in nature.

Colonel Henry S. Graves

It is a great pleasure to announce that Colonel Henry S. Graves has accepted membership on the Honorary Advisory Council of the Roosevelt Station. As the distinguished former Chief Forester of the United States Forest Service, that branch of the government under his leadership made great progress. Colonel Graves, as the first Director of the Yale Forest School at Yale University, has been the teacher and inspirer of the largest body of trained foresters which this country has yet produced. It was mainly under his guidance and supervision that the various constructive animal and wild life activities of the Forest Service have developed. This is particularly true of the development of grazing as a phase of forestry, the problem of predatory animal control, the Yellowstone elk problem, and the comprehensive plans for fish and game in our National Forests. The relation of wild life to the recreational uses of the forests he grasped far in advance of the times and paved the way for its unprecedented progress. The antiquated view that animals were merely a phase of protecting the forest from injury he long ago discarded, because he saw that animals are not merely an incident in forestry but an aspect of forest production which is of basal economic and social value. Colonel Graves has just returned as Dean to the School of Forestry, Yale University, and this assures this institution of the leadership which it has so long maintained.

Gifts to the Library and Collections

The former Ichthyologist of the Station Staff, Professor T. L. Hankinson, on his departure, presented to the Station nearly 200 reprints, pamphlets and books. These are a very welcome addition to the Roosevelt Wild Life Library. He also presented to the fish collection over 150 lots of fresh water fishes, a series which for comparative purposes will be very valuable.

The latest contribution to our game collection is a mounted Moose head, collected by the donor, Mr. Irving D. Vann, Attorney, of Syracuse. This very appropriate addition to our game collection was taken by Mr. Vann in the Touradif River, Rimouski County, Quebec, September, 1912.

Contributions of the above character materially aid the progress of the Station, and the Station is grateful to the donors for these contributions.

Reception of the Bulletin

The first number of the *Bulletin* has been received so heartily throughout the State and Nation as to leave no possible chance for

doubt as to the unique field and opportunity for the Roosevelt Wild Life Station. Examples of a few representative opinions are here given:

1. "This is an extraordinarily interesting and valuable publication and will be cordially appreciated by the many friends of Theodore Roosevelt."

2. "It is not merely interesting, but valuable. That it would be the latter is to be expected, but so many professional bulletins of the past have been written from the point of view of mere fact without making them human that I fear the general public has begun to distrust such publications. There is no reason for that feeling about Volume 1, Number 1."

3. "It is the work of supplying this knowledge of animal life through scientific research and experiments, a knowledge of which Mr. Roosevelt so clearly saw the necessity, that the Wild Life Experiment Station has undertaken as its chief purpose. The first reports indicate that it has met with a gratifying success in carrying out the plans of this distinguished naturalist." Editorial, *New York Herald*, January 30, 1922.

4. "The first *Bulletin* of the Roosevelt Wild Life Forest Experiment Station of the New York State College of Forestry * * * indicates that despite the handicap of its cumbrous and complicated name it is functioning successfully and with definite plans and clear promise of usefulness. * * * The main facts and principal figures in the movement so far, [are given] so that any intelligent reader may know and understand just where the Station fits in among the many Roosevelt memorial and conservation projects, just what authority and resources are behind it and just what it expects to accomplish. Colonel Roosevelt himself, as long ago as 1917, carefully examined and cordially approved the project which has a distinctive and fruitful field of its own, altogether unlike and outside of the other agencies, corporate or official. * * * Two incidents of the *Bulletin* are noteworthy: publication in full of the late George W. Perkins' memorable paper in 1917 to the American Association for the Advancement of Science, in which he demanded that the scientists should teach the world how to use and assimilate the forces, like steam and electricity, which they have discovered, and a resume of European plant and animal preservation, which make the *Bulletin* as a whole remarkable for range, interest and value, a striking and welcome contrast to publications of this type and bespeaking much for its future and that of its supporters." Editorial, *The Standard Union*, Brooklyn, February 10, 1922.

5. "This *Bulletin* would be worth while for the collection of portraits it contains, if for no other reason, but I am especially interested in the outline of policy."

6. "It is very well gotten out and is a highly effective document so far as the public is concerned, and will certainly be gratifying to all the friends of the Colonel."

7. "While I have not had the opportunity to read it thoroughly I have gone through it sufficiently to get the salient points, and I want to take this opportunity of expressing my interest in this memorial to the Great American. No more appropriate memorial could be devised.

"I am especially interested in the plan to study the animal life. In his foreword Dr. Grinnell brings out admirably a point of which I became increasingly aware in my own work, namely, that there is a great lack of information as to the most common habits of many of our most familiar wild animals. A rather extended experience as a writer of animal stories for children has convinced me that it is the common things, the simple things pertaining to the daily lives of our woodland and meadow creatures, that are of greatest interest to the public at large. This is as true of adults as of children. Time and time again I have had letters of inquiries regarding the traits or habits of familiar animals which I could not myself answer from personal experience, and which I have been unable to find in the published works of our best authorities. The latter have been so engrossed in the scientific relations of one to another that they have either overlooked common habits or else have considered them too trivial to be of interest. It has been astonishing to me to find how often comparatively little is known of the daily lives of our most familiar creatures. Therefore I rejoice that the Roosevelt Experiment Station is to take up this line of work.

"I note that it is proposed to assemble a library of books, photographs, and publications pertaining to forest wild life. I do not see moving picture films included. [This is an oversight as provision was made for these. C. C. A.] It seems to me that somewhere in this country there should be a complete collection of all good moving picture films of American wild life which have been made or will be made. I know the American Museum has a very good collection of such films, but I also know that there are very many films not possessed by the American Museum or any other museum. It seems to me that every motion picture photographer should be willing to contribute a print from every reel he makes providing that he is assured that such reels are not being used in any way to conflict with his own use of the material. A museum of mounted specimens is of course of the utmost value to the student, and to the public at large, but of equal value it seems to me are motion pictures showing the living creature in its natural environment and concerned in the daily affairs of life."—THORNTON W. BURGESS.

8. "I have just received the first issue of the Roosevelt Wild Life Bulletin * * * and have taken a keen delight in reading it. What you are planning to do at the Roosevelt Wild Life Experiment Station is, to my mind, one of the most important and significant things in connection with wild life conservation of this day. So far as I know it is the only movement and effort of the kind and is, without the possibility of a doubt, on the right track. * * *

"One of the statements made in the *Bulletin* which I was glad to note is that your activities will not be confined exclusively to New York State. There is the same lack of accurate knowledge of wild animal life everywhere."

The Beaver Investigations

The present number of the *Bulletin* is largely devoted to the results of investigations of the beaver. Although the beaver abounded in New York State in primeval days, it became almost extinct on account of the relentless trapping which was permitted. Later, when its loss became appreciated, beavers were imported into the Adirondacks where they have again become so abundant that they are now locally injurious.

Although the beaver has been the subject of more detailed studies, and more books have been written upon this than upon any other native land mammal, yet our need for knowledge of it has grown more rapidly with the shrinkage of the wilderness by the encroachments of man than we have been aware. Fifty years ago we were considered relatively well informed on the beaver, while today the whole field needs recultivation by more intensive modern methods.

A native of this State, Lewis H. Morgan, in 1868 published a classic monograph "The American Beaver and His Works," a book which has not yet been surpassed, and most of our knowledge of this animal has been derived from other regions than this State. Now that New York beavers demand attention investigations are needed to inform ourselves upon the natural history of this species before they can be properly protected and utilized.

Dr. Johnson's report points out some of the many problems which now need immediate investigation, and much emphasis is placed upon the fact that in the absence of a proper knowledge of them legislation is necessarily provisional and experimental in character. Laws cannot command the respect which they should merit when they rest upon an insecure foundation of fact, and the only remedy is to increase our knowledge. To make such investigations is the distinctive field of the Roosevelt Station, and is perhaps where it can do some of its best public service.

This beaver problem raises the question as to whether or not it would be wise, during this period of provisional plans, to allow the State Conservation Commission considerable discretionary powers in their executive duties of caring for the beaver. At the

same time the scientific studies should be pushed as rapidly as possible in order to clear up the most serious defects in our knowledge.

In restocking the Adirondacks with beaver some were secured from Yanceys in the Yellowstone National Park, the locality at which Mr. Warren's studies were made. The beaver problem in Yellowstone Park is quite different from that in the Adirondacks, in that this Park is a wild life refuge, and the question of commercial damage does not enter into the problem. The public interest in these remarkable animals, however, is shared equally by Yellowstone and Adirondack summer visitors.

The detailed results of Mr. Warren's studies will form another report which is now completed.

THE ROOSEVELT WILD LIFE MEMORIAL

As a State Memorial

The State of New York is the trustee of this wild life Memorial to Theodore Roosevelt. The New York State College of Forestry at Syracuse is a State institution supported solely by State funds, and the Roosevelt Wild Life Forest Experiment Station is a part of this institution. The Trustees are State officials. A legislative mandate instructed them as follows:

"To establish and conduct an experimental station to be known as 'Roosevelt Wild Life Forest Experiment Station,' in which there shall be maintained records of the results of the experiments and investigations made and research work accomplished; also a library of works, publications, papers and data having to do with wild life, together with means for practical illustration and demonstration, which library shall, at all reasonable hours, be open to the public." [Laws of New York, chapter 536. Became a law May 10, 1919.]

As a General Memorial

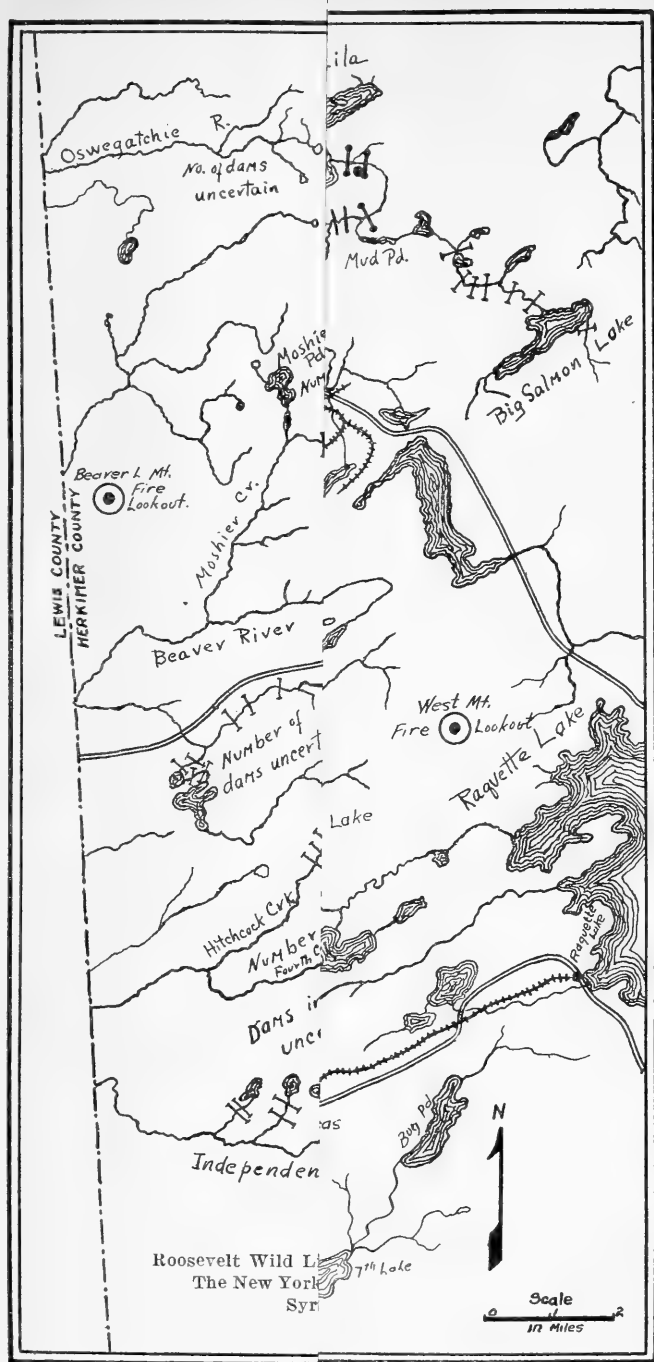
While this Memorial Station was founded by New York State, its functions are not limited solely to the State. The Trustees are further authorized to cooperate with other agencies, so that the work is by no means limited to the boundaries of the State or by State funds. Provision for this has been made by the law as follows:

"To enter into any contract necessary or appropriate for carrying out any of the purposes or objects of the College, including such as shall involve cooperation with any person, corporation or association or any department of the government of the State of New York or of the United States in laboratory, experimental, investigative or research work, and the acceptance from such person, corporation, association, or department of the State or Federal government of gifts or contributions of money, expert service, labor, materials, apparatus, appliances or other property in connection therewith." [Laws of New York, chapter 42. Became a law March 7, 1918.]

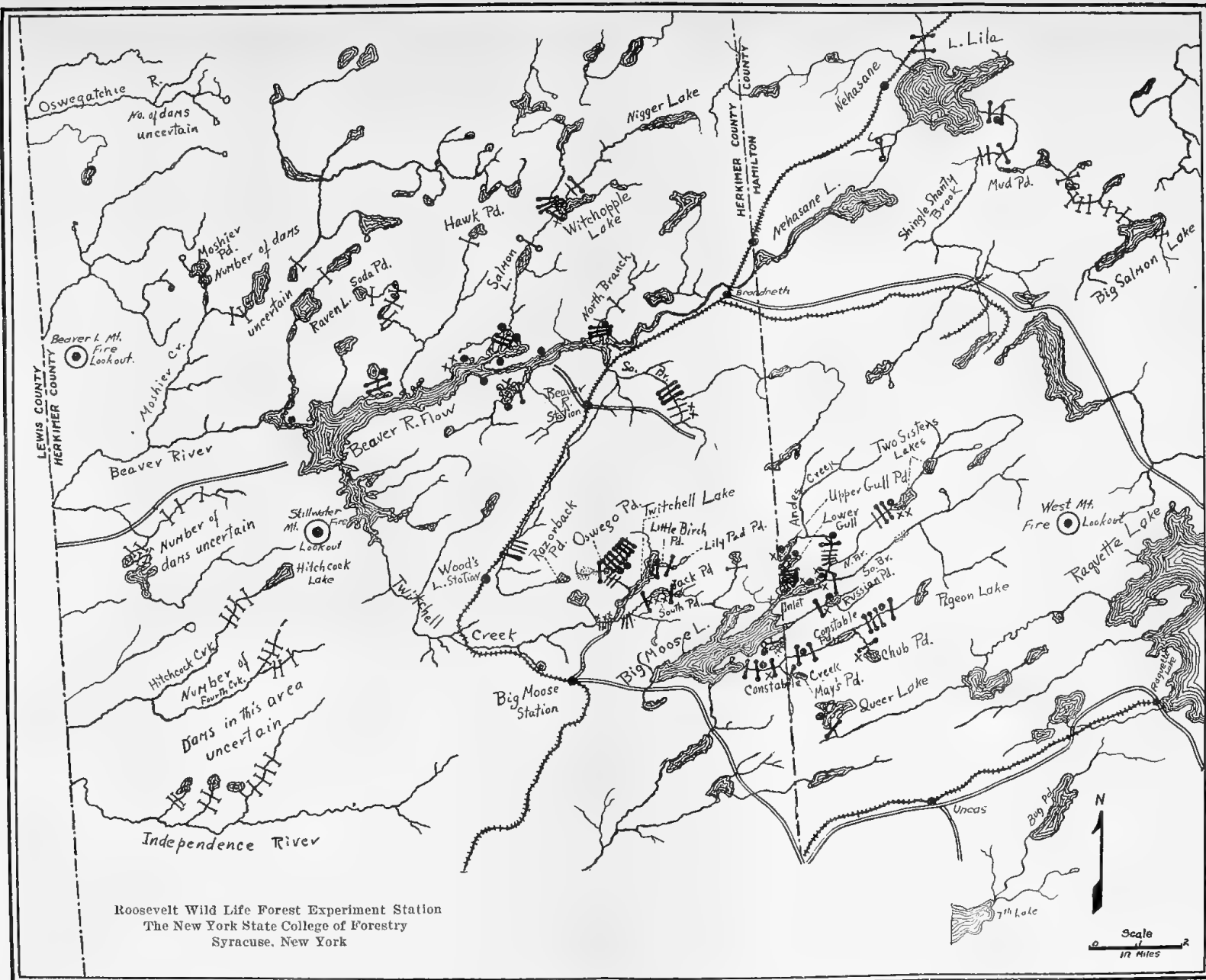
By these laws the Empire State has made provision to conduct forest wild life research upon a comprehensive basis, and on a plan as broad as that approved by Theodore Roosevelt himself.

Form of Bequest to the Roosevelt Wild Life Memorial

I hereby give and bequeath to the Roosevelt Wild Life Forest Experiment Station of The New York State College of Forestry at Syracuse, for wild life research, library, and for publication, the sum of, or the following books, lands, etc.

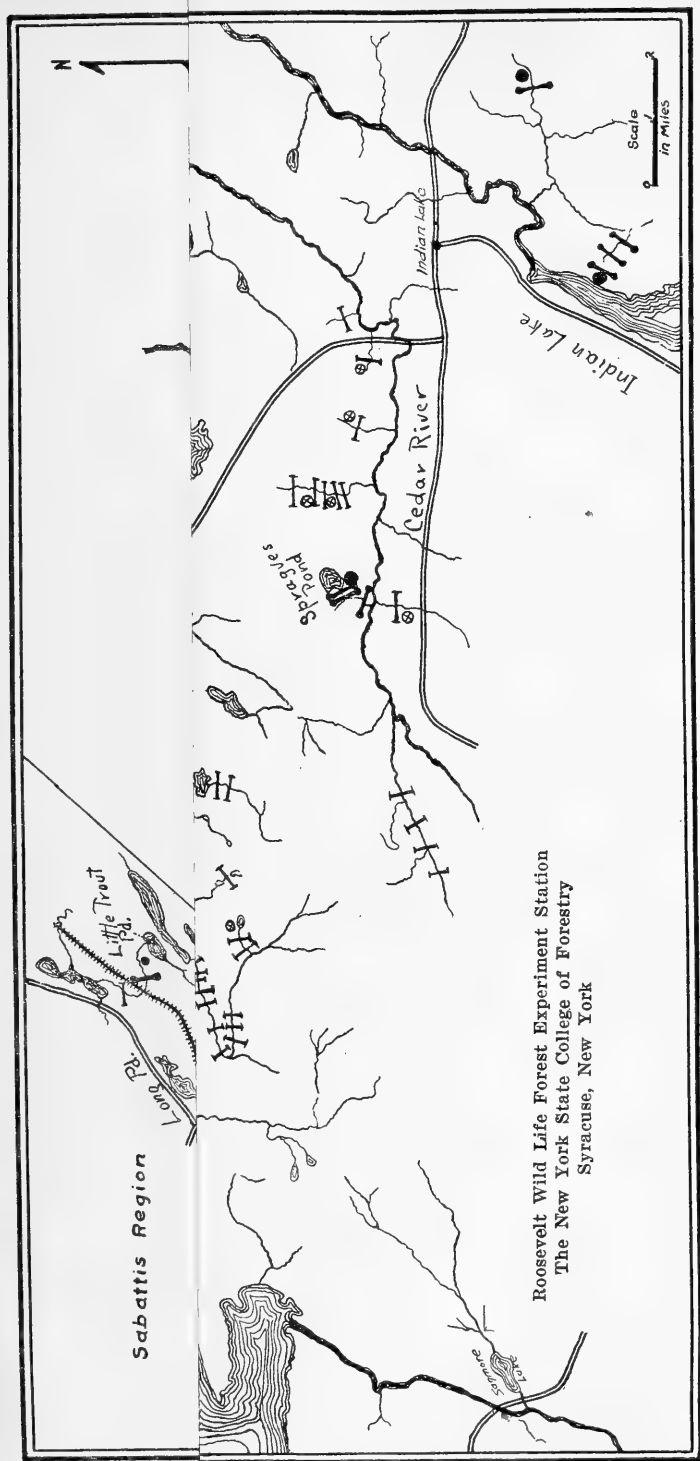


Map 1. Map of western location of beaver works.

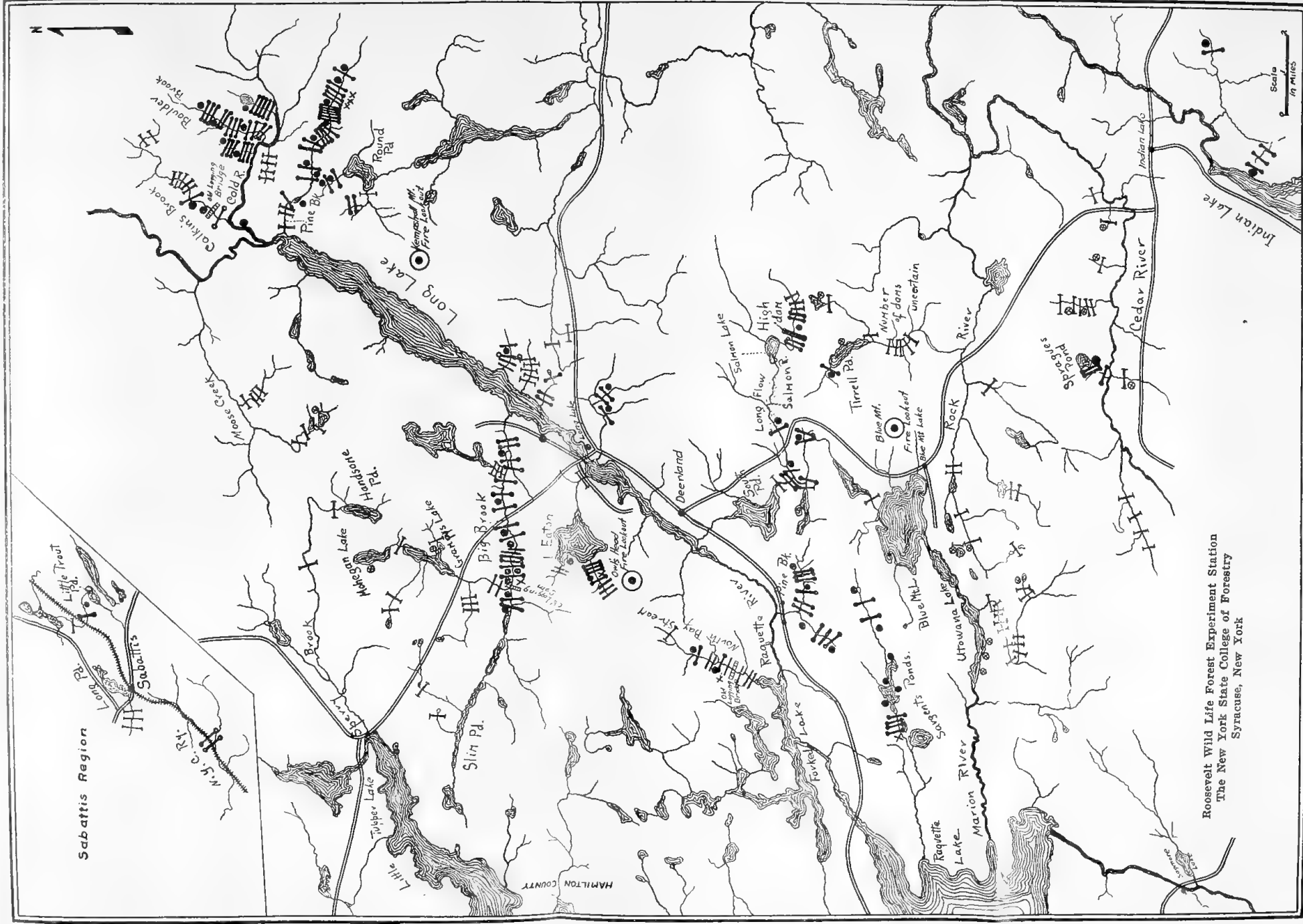


Map 1. Map of western part of area examined in Herkimer and Hamilton Counties, southern Adirondacks, and showing location of beaver works.

- | | |
|-----------------------------|------------------------------|
| ┃ Dams personally examined. | ┃ Dams torn open. |
| ┃ Old, abandoned dams. | ● Inhabited lodges. |
| ┃ Dams reported by others | x Abandoned lodges. |
| | ⊙ Lodges reported by others. |



Map 2. Map of the eastern part of area examined in Herkimer and Hamilton Counties, northern Adirondacks, and showing beaver activities.



Roosevelt Wild Life Forest Experiment Station
The New York State College of Forestry
Syracuse, New York

Map 2. Map of the eastern part of area examined in Herkimer and Hamilton Counties, northern Adirondacks, and showing beaver activities.

BEVELT REGION NE NATIONAL PARK

ON OF BEAVER WORKS

Life Forest Experiment Station
ACUSE N.Y.
1921

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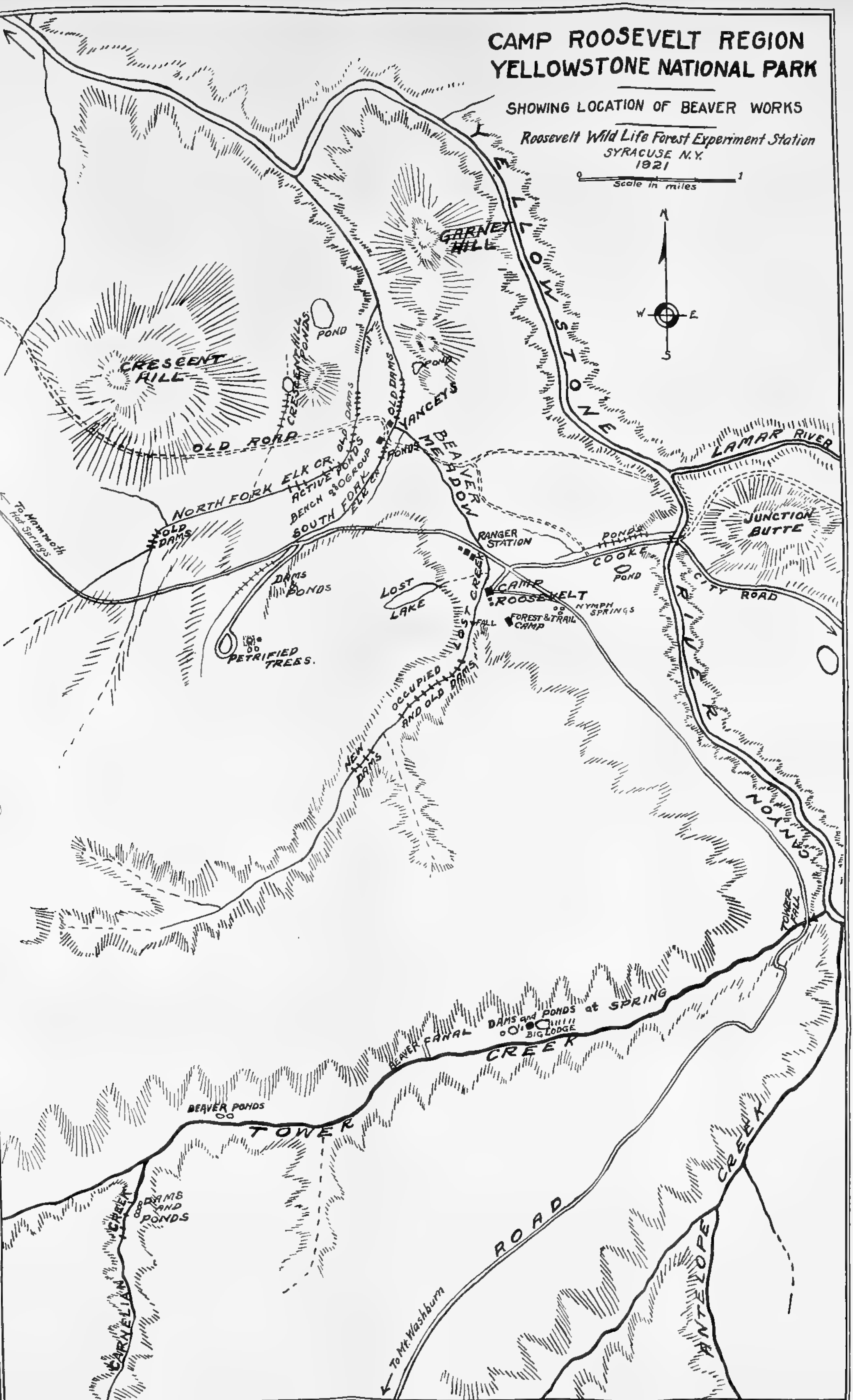
1921.

CAMP ROOSEVELT REGION YELLOWSTONE NATIONAL PARK

SHOWING LOCATION OF BEAVER WORKS

Roosevelt Wild Life Forest Experiment Station
SYRACUSE N.Y.
1921

Scale in miles



Roosevelt Wild Life Bulletin

VOLUME I, NUMBER 3

OF

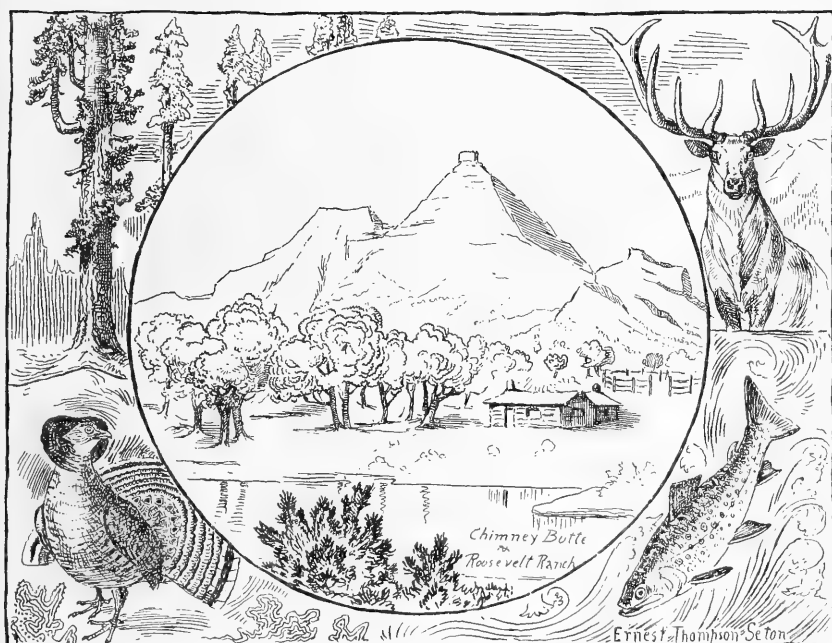
The Roosevelt Wild Life Forest Experiment Station

OF

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AT

SYRACUSE UNIVERSITY



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The serial publications of the Roosevelt Wild Life Forest Experiment Station consist of the following:

1. **Roosevelt Wild Life Bulletin.**
2. **Roosevelt Wild Life Annals.**

The *Bulletin* is intended to include papers of general and popular interest on the various phases of forest wild life, and the *Annals* those of a more technical nature or having a less widespread interest.

These publications are edited in cooperation with the College Committee on Publications.

Exchanges are invited.

CHARLES C. ADAMS

Director and Editor

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* Including only those who have made field investigations and whose reports are now in preparation.

** Resigned as Station Ichthyologist October 1, 1921.

RELATION OF BIRDS TO FORESTS

"The total damage to trees by insect pests is enormous, and several years ago was estimated to exceed \$110,000,000 annually. Not only is the damage extremely large, but the difficulties of directly combating insect pests in forests are so great that man is able to do comparatively little. The services of natural enemies of the destructive insects should therefore be highly appreciated. If they serve to reduce the damage by only a small percentage, the gain to the country is a very large sum. Among these enemies, birds are conspicuous. Their services are well known and have long been acknowledged. No reasons have thus far developed for considering any other group of the natural enemies of forest insects in general, more important than birds."

W. L. McATEE.

American Forestry,

Vol. 21, pp. 681-682; 1915.

"Birds are not only essential to the welfare of the tree, but the tree is necessary to the life of the bird. Consequently, there has been established what is termed 'a balance of life' wherein there is the most delicate adjustment between the tree, the insect, the bird and the sum total of the conditions which go to make up their environment * * *. Birds are of value to the forest, however, not only as the destroyers of their insect foes, but the birds with the squirrels, help plant the forest by distributing seeds. The seeds which are encased in a pulpy covering, those of the berry or fruit-bearing trees, are voided unharmed by the birds often at a point far distant from the parent tree, the bird thus acting as their distributor. Acorns, beech-nuts, and chestnuts are frequently dropped or hidden by birds, and the seeds of pines are released and scattered by the birds that seek them in their cones. In short, we believe it can be clearly demonstrated that if we should lose our birds we should also lose our forests."

FRANK M. CHAPMAN.

*Seventh Report N. Y. Forest, Fish and Game
Commission*, pp. 117, 120; 1901.

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RELATION OF MIGRATORY BIRDS TO FORESTS, THE STATE AND THE NATION

"The necessity of the preservation of bird life to the continuance of the life of our national forests, and of the preservation of our agricultural resources or, in other words, the dependence of forest and plant life upon bird life, is thus demonstrated."

LOUIS MARSHALL.

Brief to Supreme Court of the United States,
October Term, 1919, No. 609, p. 41.

"On December 8, 1916, a treaty between the United States and Great Britain was proclaimed by the President. It recited that many species of birds in their annual migrations traversed many parts of the United States and of Canada, that they were of great value as a source of food and in destroying insects injurious to vegetation, but were in danger of extermination through lack of adequate protection. * * * Wild birds are not in the possession of anyone; and possession is the beginning of ownership. The whole foundation of the State's rights is the presence within their jurisdiction of birds that yesterday had not arrived, tomorrow may be in another State, and in a week a thousand miles away.

"Here a national interest of very nearly the first magnitude is involved. It can be protected only by national action in concert with that of another power. The subject matter is only transitorily within the State and has no permanent habitat therein. But for the treaty and the statute there soon might be no birds for any powers to deal with. We see nothing in the Constitution that compels the Government to sit by while a food supply is cut off and the protectors of our forests and our crops are destroyed. It is not sufficient to rely upon the States. * * * We are of opinion that the treaty and statute must be upheld."

JUSTICE HOLMES.

Decree, Supreme Court of the United States,
October Term, No. 609, 1919.

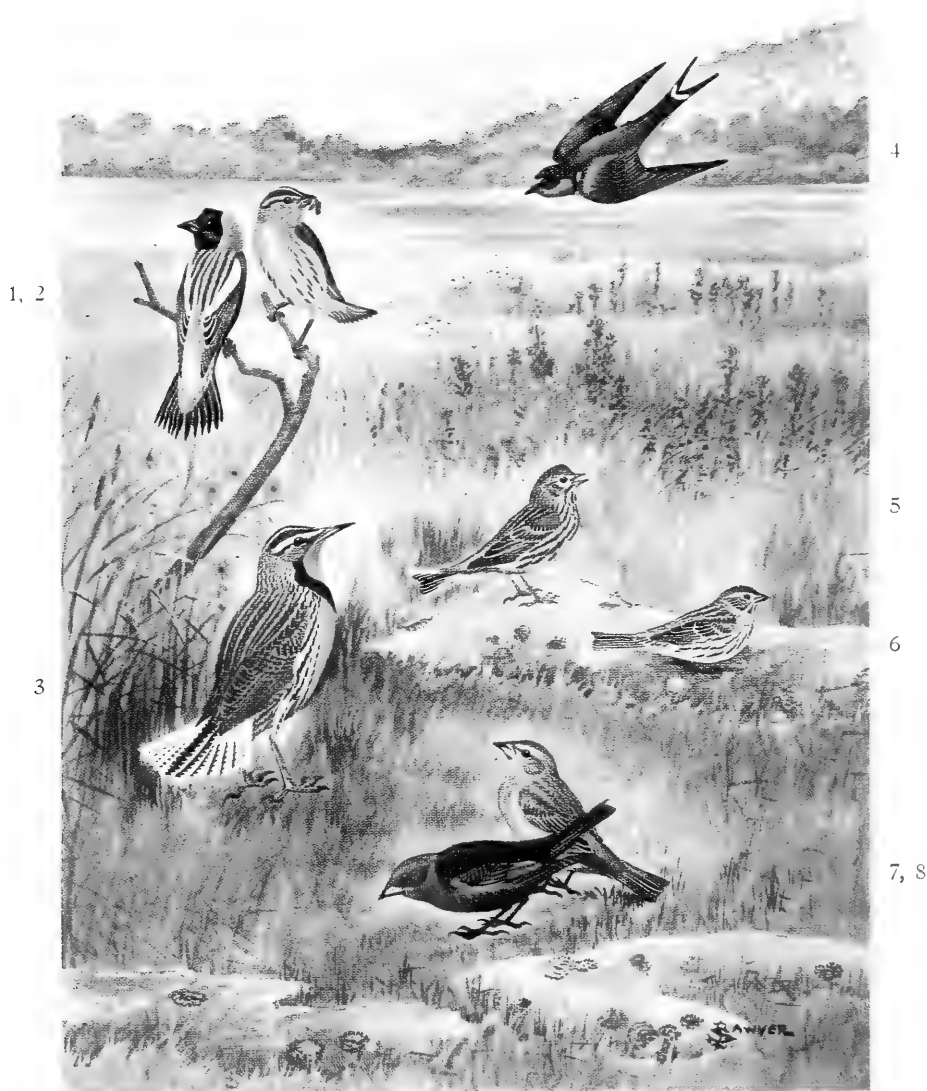


PLATE 25. BIRDS OF THE OPEN FIELDS, ALLEGANY STATE PARK

1, 2, Bobolink (male and female).

3, Meadowlark.

4, Barn Swallow.

5, Vesper Sparrow.

6, Savannah Sparrow.

7, 8, Cowbird (male and female).

Drawn by Edmund J. Sawyer

THE SUMMER BIRDS OF THE ALLEGANY STATE PARK

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INTRODUCTION

The Allegany State Park is situated in the southwestern part of New York in Cattaraugus County south of the bend of the Allegheny River, and about 75 miles south of Buffalo (map 4). The area ranges from a little over 1,300 to about 2,500 feet in elevation, and consists of rather low mountains naturally wooded to their tops with forests that are mainly of broad-leaf deciduous species (figure 71). The present size of the Park is 7,000 acres, and this will probably be increased to at least 65,000 acres.

While bounded roughly by the river (figure 72) the Park area nowhere touches it, as the Allegany Indian Reservation includes

the land for half a mile on either side of the river. Since all main roads of approach to the Park pass through the Reservation, the birds found within it have also been included in this report. Wherever a species was found only on the Reservation and not in the Park area, mention has been made of that fact.

While the greater part of the Park is wild, forested land, there are numerous settlements both within the area and near the border. Just north of the Park, on the Allegheny River, lies the attractive little city of Salamanca, a center for three railroads, and a point from which all accessible parts of the Park may be reached by either railroad or automobile. On the east side of the Park, in the valley of Tunungwant Creek is the village of Limestone, connected with Salamanca by both the Erie and the Buffalo, Rochester and Pittsburgh Railroads. From this point the Tunungwant Valley, an area of different character than other parts of the Park, Limestone Brook and Rice Brook are accessible; and by the road up Limestone Brook the head of the Red House Valley may be reached. From Salamanca, the Pennsylvania Railroad follows down the Allegheny Valley to stations on the west side of the Park. From Red House on this railroad, good automobile roads lead up the Red House Valley, one of the most scenic parts of the Park, and up Little Red House or Bay State Creek. Farther south on the river is Tunesassa, or Quaker Bridge, as it is known to the railroad, which is central to the valley of Quaker Run (figure 73) and the main area that has already been acquired by the Allegany State Park Commission and opened up for the use of campers and visitors.

In the larger valleys, such as Red House and Quaker Run, are numerous farms, and much land under cultivation (figure 72). The greater part of such land lies in the valley bottoms, where the soil is rich. A few places on the hillsides have been cleared and cultivated and used for pasture, but the majority of the hills remain forested. Nearly all the forested areas have been cut over, and the bulk of the forest is second-growth. In the Big Basin at the head of Stoddard Creek, near the head of Red House Creek, and in a few other scattered areas of small size, the forests are old, mature, and except for the culling of a few trees of the more desirable species, are untouched by the axe.

The purpose of this publication is not solely to furnish a guide that will be helpful to the visitors in the Park in learning the names of the birds they see, and understanding more fully their ways of living; but also to describe the ecological distribution of the birds; to outline a general plan for their preservation in the Park, because of their great recreational and educational value; and to assist in the conservation of the game birds, that the good hunting now to be found in the region may be maintained in the future.

That the abundance of bird life in a given region, the proportionate abundance of each species, and the problems connected with the preservation of each species all depend upon its ecology or relation to its surroundings, is a fact that is none too thoroughly realized. For these reasons, as well as for the fact that it will be helpful to the bird student who wishes to know where to look for

certain birds, I have grouped the species in the main text, in ecological associations, rather than in taxonomical order. Because bird life is directly or indirectly dependent upon other forms of wild life, and primarily upon the vegetation, I have described at some length these associations and the principal kinds of plants found in each. It is of course true that no two species of birds live under exactly the same ecological conditions. Some species grouped in one association occur also in others, not all individuals of the species living under the same conditions. Within the same association, different species live differently, dependent in a different way upon it. Some species depend upon conditions in one association for a nesting site, but obtain their food chiefly within another, the individual living in two or more associations. For these reasons it is often difficult to determine in which association to place a given species, and the grouping is therefore somewhat artificial.

A complete ecological study means a study of each species and its interrelations with various plants, insects, mammals, other birds, and all forms of wild life which constitute its associates and enemies. It also includes food, nesting sites or nesting materials and the complete physical habitat. Such an extensive study is beyond the scope of this work, but the outlining of general bird ecology of the region will serve as a foundation for detailed studies in the future. It is obvious that the abundance of a species in a given region is determined not merely by geographical range but also by the conditions within the association in which it must live, and by the relative abundance of other forms of life in that association which affect it. This makes the study of the ecology of birds of primary importance in working plans for the conservation of bird life.

Within each association I have listed the species in the approximate order of their abundance. This order was determined partly by general observation, and partly by making counts of singing birds along the roads, or at points in the forest. I made allowances for the fact that some species had slackened or ceased singing before my arrival in the region, and that in the case of certain species some individuals cease to sing for long periods, so that all individual males are never completely in song together through the nesting season.

This list is based upon a study of the birds of the region occupying a period from July 3 to August 13, 1921. During this time an effort was made to cover as much of the Park area as possible, and particularly to include areas widely varying in character.

For those who are beginning a study of birds, or who know only a small number of the commonest species, a mere local list is not of great value. For this reason I have included the section on the identification of birds in the field, and the field key. I have not tried to give full and complete descriptions of birds such as might be made from a study of skins or mounted specimens, but have emphasized mainly the field characters of each species. Detailed descriptions are not of great use to the outdoor student as

they often over-emphasize characters that are not apparent in the field, and leave out the points concerning general appearance, habit, and voice that are most useful there. I have attempted to describe songs as accurately as is possible, without actually making definite song records for each species, in the hope that the descriptions will prove of value. These descriptions in most cases are not based on study in the Allegany Park alone, but on investigations in various other localities also. I had had some previous field experience with all the species thus far found in the Park. My former acquaintance with the Mourning Warbler, however, was decidedly meager and did not include its song, while my previous observation of the Cerulean Warbler had been made so long ago that it was now almost like seeing and hearing a new bird.

For the beginner I would suggest that this publication be combined with some good general bird guide, and that no attempt be made to use it alone, since other species besides those listed are likely to be found in the Park. There are numerous good popular bird guides, but I would particularly recommend Chapman's "Handbook of birds of Eastern North America" (1914), or Hoffmann's "Guide to the Birds of New England and Eastern New York" (1904). The former is the most complete and authoritative guide that has been written, and is invaluable to one who intends to take up serious ornithological study. The latter, the work of a close and careful field student, contains many hints on habits, notes, or differences between puzzling species that make it extremely useful in the field. The Reed "Bird Guide, East of the Rockies" (1913) has the advantage of small size, low price, and a colored portrait of each species; but the small size makes it impossible to include much information, and in some copies the colorings are not very accurate. Eaton's "Birds of New York" (1910-1914) will also be found most useful because of the local records and migration dates for various parts of New York State, as well as the excellent and almost complete set of colored plates. This work, however, is too large and heavy for field use.

For beginners I should like also to recommend what Silloway has written on the subject of bird study in his "Guide to the Summer Birds of the Palisades Interstate Park" (1920, pp. 17-22). Job's "How to Study Birds" (1910) is a delightful and most helpful book, especially for the would-be camera-hunter. Forbush's "Useful Birds and their Protection" (1913) leads to an appreciation of the economic value of birds and their role in nature. Those who have developed a deeper interest in bird life and wild life generally, and are concerned about its ultimate fate, will do well to read Adams' "Suggestions for the Management of Wild Life in the Allegany State Park" (1921).

All scientific names of birds and plants occurring in this paper correspond respectively with those in the "A. O. U. Check List of North American Birds" revised to date, and "Gray's Manual of Botany," 1908 edition. The reader is referred to the special list of papers of value to the student of bird life in Allegany Park, on pages 348-349.

PRESERVATION OF BIRD LIFE IN ALLEGANY PARK

Enemies of Birds and the Balance in Nature. In a great recreation area such as the Allegany State Park is destined to be, bird life is a most valuable asset. Birds are useful not only economically as destroyers of forest insects, but also esthetically and from the standpoint of recreation and education. Bird life should therefore be carefully encouraged and protected.

The possibilities with this object in view will include certain constructive lines of work. We can protect birds from enemies that would tend to decrease their numbers. We can attract birds to the Park or to camps or summer homes by making conditions favorable, and to a limited extent we may increase their numbers. In the development of the Park we can avoid the many procedures which would tend to decrease and discourage bird life, however unintentional such a result might be.

In the protection of birds we may place their enemies in two classes: the wild, natural enemies, and those enemies for which man is responsible. The wild and natural enemies of birds have long existed within the Park area. These consist of various mammals such as the weasels, mink, fox, lynx, skunk and squirrels; birds themselves, including hawks, owls, jays, crows, and even smaller forms such as the Red-headed Woodpecker, Cowbird and House Wren; snakes; and probably parasitic forms among insects and worms. In considering these enemies, we must realize the existence of what has been termed the balance of nature. Each kind of animal has its own struggle for existence. It must obtain food, escape its enemies and reproduce its kind. In this struggle it depends upon other forms of wild life which furnish in one way or another food and shelter, and in the case of birds, nesting sites and nesting materials. In this same struggle its enemies must prey upon it, annually decreasing its numbers to nearly the same extent that it increases them by reproduction. Each species is dependent upon its associates in one way or another, and these species in turn upon still others. The interrelations between different forms are therefore exceedingly intricate. The decrease or increase of the numbers of any one species causes a corresponding increase or decrease in some other species, and that in turn of a third. When man, through wholesale destruction of some species supposedly harmful to him, disturbs this natural balance he may not merely decrease the harmful kind, but tend to increase some other much more harmful, or decrease some beneficial species. It is probable that the outbreaks of harmful insects in vast and almost uncontrollable numbers might be traced back, if we understood the interrelation of forms of life, to some disturbance of nature's balance by man.

Further than this, the wild enemies of birds weed out from their ranks the weaker individuals, those less fitted for the struggle for existence. If through destruction of these enemies, the weaker ones increase, disease or parasitic enemies may start, and spread from weaker to stronger and do far more to decrease bird life than other natural enemies ever would.

Wild enemies of birds include not only many birds themselves but also other desirable forms of wild life that have a distinct educational and recreational value. The sentiment that condemns every form of wild life which preys upon song birds, calling it blood-thirsty and cruel when it is merely living its life as nature taught it to live, is wrong and misplaced. Is not the Robin, when it preys upon the earth-worm, quite as cruel and blood-thirsty as the Sharp-shinned Hawk when it preys upon the Robin?

For these reasons many efforts to destroy the wild enemies of birds are ill-advised (cf. Forbush, '13). In the administration of the Allegany State Park it will be wise to make an effort to keep wild life in a natural balance, without exterminating any one species because it is an enemy of some other that may seem more desirable, except in the areas set aside wholly for fishing and hunting. Enemies of birds in the Park, other than the native forms of wild life, are man, the cat, the dog, the European Starling and English Sparrow. There are probably others, but these are the most important. Man is responsible for all of the introduced species, and to a certain extent able to control them.

Control of Enemies of Birds. In controlling man two methods are useful: legislation and education. Legislation for general protection of birds already exists in the form of good State and Federal Laws. There may be occasion, however, for special legislation protecting all forms of life on certain areas, or prohibiting hunting within areas set aside as game preserves. The character of the majority of visitors to the State Park will undoubtedly be such that the usual routine of law enforcement to protect bird life will be all that is necessary. The few cases that may arise through either malicious intent or ignorance of the law should be dealt with in such a way as to discourage further cases. Park visitors and campers who desire to help can exercise a good influence if, when they meet with those who are ignorant of the laws and purposes of the Park, or who may be inclined to destroy wild life, they make a point to inform such persons of the value of such animals in the Park. Educational measures may be taken in many ways, such as the posting of signs at appropriate places in the Park, the publication and distribution of pamphlets, the printing of articles in newspapers and magazines, and the employment of nature guides.

The cat is fully as destructive to bird life as the worst of wild enemies. Unlike the latter it has not the same struggle for existence. It depends upon man to feed and shelter it. If it cannot succeed in catching prey there is ordinarily no danger that it will starve. It need not face the cold and hunger of winter that wild creatures endure. Without these forces to keep its numbers in check and with no diminution of its hunting instincts it becomes a greater menace to bird life than all the wild natural enemies. Cats should therefore be discouraged in the Park. There are possibilities of good legislation to control them in the future; but aside from this it is recommended that campers or those who lease summer

home sites within the Park be not allowed to bring in or keep cats (cf. Forbush, '16).

The dog is less harmful to bird life than the cat, and more easily controlled. Dogs running at large often destroy birds and ground nests as well as small mammals and other forms of wild life. Dogs should not be allowed to run loose in the Park except when used for hunting during the regular hunting season.

The English Sparrow and the Starling are not enemies in that they prey upon other birds, but in that they annoy and drive out native species, upsetting the natural balance. The question of the economic status of these two birds is a difficult one, both of them being at times valuable insect destroyers, and at other times harmful in food habits. It is not probable that they directly drive off all native birds, as has been charged, but they displace hole-nesting species such as the Bluebird and Flicker. Were there no English Sparrows in the Park it would not be difficult to get nesting colonies of the beautiful Purple Martin. When the Starling increases in the region, as it pretty certainly will, Bluebirds and Flickers will be liable to decrease.

Nor is the question entirely one of nesting sites. These introduced species undoubtedly get food that other species depend upon. The Starling, particularly, is almost omnivorous, eating insects, fruits and seeds. Its flocks will often get large quantities of wild fruit that other species such as the Cedar Waxwing, Robin and Catbird have more or less depended upon. In open fields it probably gets both insects and seeds that have formerly been food for Bobolinks, Meadowlarks, Red-winged Blackbirds and others. Just how these birds are to be combated is a complicated and difficult question, but certainly no protection and every means of discouragement should be used in the State Park. Any practicable means of getting rid of them that may present itself in the future and seem to promise success should be tried.

Methods of Attracting and Increasing Birds. The problem of attracting birds to the Park in general, is hardly necessary to consider, as birds are already there in about natural numbers. The question of attracting particular species, however, or of enticing birds about camp sites and summer homes, may well be considered.

There are four principal things that can be done to attract birds. These are the placing of bird houses for hole-nesting species; the constructing of drinking and bathing places; winter feeding; and the planting of trees, shrubs or vines particularly attractive to birds.

There are nine species now known to nest in the Park that are desirable and could be attracted about camp sites by the placing of nesting boxes in suitable situations. These species are the Bluebird, Robin, Chickadee, Nuthatch, House Wren, Crested Flycatcher, Flicker, Screech Owl and Sparrow Hawk. The English Sparrow and Starling will also occupy bird boxes in their favorite localities, but should not be allowed to do so. The Purple Martin, while not included in this list, is reported to occur occasionally in Salamanca. There seems reason to believe that colonies could be

established in the Park by erection of the proper kind of bird houses in the more favorable localities. It would seem as though other species of swallows could be attracted by the erection of special structures similar to those they commonly use for nesting, but I have never heard of this being tried. It might also be possible to attract such a species as the Wood Duck.

The setting up of bird boxes should be undertaken by someone well acquainted with the subject and with the preferences of the species to be attracted. Artistic looking but wrongly constructed boxes will not meet with success. The placing of a box for a certain species in the wrong locality will be equally bad. Chickadees and Nuthatches prefer the forest. Bluebirds, Robins, Wrens and Crested Flycatchers like the more open orchards. Martin boxes should be placed only in the open and not under trees. The size of the box and its opening will depend upon the species to be attracted. The Robin will not occupy the ordinary box with a small hole for entrance, but wants simply a floor and a roof, with one or more sides entirely open.

There are many cases of city parks or private estates where bird boxes have been set up without any special study of the subject, with the result that very few are occupied, or are mainly tenanted by squirrels, English Sparrows or Starlings. It may be desirable to furnish houses for squirrels also, but the matter should be handled with such care that those meant for birds should not be occupied by the squirrels.

Drinking and bathing dishes are a great attraction to birds on hot summer days; and they are a successful means of bringing many species to the vicinity of camps or homes where they may be easily observed. Almost all song birds bathe or drink at times. Even near streams and lakes birds like small drinking and bathing places and are attracted by them.

A few points should be observed concerning the drinking and bathing dish. Different depths seem to attract different species; and a bath with a gently sloping bottom, providing different depths at different points along its length, would probably be most successful for the greatest number of species. The height of the rim above the water, where birds may perch to drink, is also important. Placing large flat stones in the water, so that they come just above its surface, will be found an attraction. The water should be fresh, and not allowed to evaporate wholly. Probably interested children or other campers could be prevailed upon to keep the dish well supplied through the camping season. Provision for a constant supply of running water is desirable where such a thing is easily possible.

Feeding of birds is best accomplished in winter when food is scarce and birds are at times in danger of starvation. In summer, when food is abundant, it is better to leave the birds to gather their own natural foods, that they may be of greatest benefit to forests or farms. Since the Park will be visited mainly in summer, and the winter birds will be largely different species or individuals than the summer ones, it may not be convenient or desirable to conduct win-

ter feeding, except perhaps with game birds, species that are given special consideration on pages 249-253 of this report.

The fourth method of attracting birds, by the planting of trees, shrubs or vines, is not particularly necessary in the Park, except in special places, because it is already well supplied with native species that are attractive. There are a few favorite kinds with particularly attractive fruits that are native but not abundant in the region, and these could probably be planted successfully. They include the red mulberry (*Morus rubra*), a great attraction to summer birds; the high-bush cranberry (*Viburnum Opulus*); the mountain ash (*Sorbus americana*); and others. These are examples of trees and shrubs that would undoubtedly be a lure to many birds, inducing some to linger in certain localities and perhaps remain over winter; but they would probably not noticeably increase bird life in the Park.

Preservation of Natural Conditions in Parks. While the various methods of attracting birds may be practiced with benefit, it is of greater importance that the present conditions, which already make the Park very alluring to birds, should not be greatly changed (cf. Adams, '21). Often in city parks, authorities interested in attracting birds set up bird boxes and drinking fountains, feed the birds in winter, and plant favorite food plants; but all of these efforts are offset by the fact that in making roads, drives, paths, picnic grounds, etc., natural conditions are destroyed, and bird life is less abundant than when the region was wild. In the development of the Allegany Park this can be avoided. The various uses to which the Park is to be put must all be kept in mind and coordinated, so that activities to create one result will not seriously interfere with those that have other objects in view. The area of the Park is ample for the construction of roads and trails, picnic and camping grounds, and for providing leased summer home sites without interfering with bird life.

While there are nine species of birds in the Park that will occupy bird boxes if erected, there are at least eighteen species that depend upon low, thick bushes for nesting sites, and many more that often use such places as a protection from natural enemies. The preservation of shrubbery, particularly thick, thorny bushes or tangles of vines, is of great importance.

It is noticeable that most birds prefer open areas, edges of woods, or thick bushes that grow in good-sized clumps with open spaces between, rather than dense growths of large area. The creation of roads, trails and camp sites will in this respect make conditions more favorable to bird life, so long as the intervening shrubbery is not removed. These principles should be kept in mind in developing the Park, and making all parts of it more accessible to visitors. No unnecessary removal of undergrowth and thickets with the idea of making things "ship-shape" and park-like should be allowed. To most people the natural growth is really more beautiful than open, formal groves of trees, or roadsides bare of bushes and vines.

Many species of wild trees, bushes and plants that now grow naturally in the Park bear fruits that are eaten by birds. Among these are the black, red and choke cherries (*Prunus serotina*, *P. pennsylvanica*, and *P. virginiana*), the virginia creeper (*Psedera quinquefolia*), the river grape (*Vitis vulpina*), the sumacs (*Rhus typhina* and *glabra*), the poison ivy (*Rhus toxicodendron*), the shad bush (*Amelanchier canadensis*), the white thorns (*Crataegus coccinea* and *Crus-galli*), the flowering, alternate-leaved, and silky dogwoods (*Cornus florida*, *C. alternifolia* and *C. Amomum*), the several species of raspberries and blackberries (*Rubus*), the viburnums (*V. acerifolium*, *V. alnifolium* and *V. dentatum*), the elder (*Sambucus canadensis*), the pokeweed (*Phytolacca decandra*), and the purple nightshade (*Solanum Dulcamara*). With the exception of the poison ivy and the nightshade, there is no reason for removing any of these plants except where roads, trails, camp sites and similar improvements are to be constructed. Other wild plants are attractive in a number of ways. The thistles furnish food and nesting materials for Goldfinches. The bee balm (*Monarda didyma*) and the cardinal flower (*Lobelia cardinalis*) are special favorites of the Hummingbird. Many grasses and weeds furnish food for the seed-eaters in fall and winter. This is also true of alder, birch, ash, tulip and hemlock among the shrubs and trees. Most of these various plants, being objects of beauty when in flower or fruit, are useful for other reasons than their relations to birds.

In the forest the old dead stumps and trunks of trees furnish nesting sites for the Woodpeckers, Nuthatches and Chickadees. Their complete removal might mean the elimination of these resident birds. In the practice of forestry it is customary to remove all such debris because it is supposedly a fire menace and a breeding place for destructive fungi and insects; yet I question the wisdom of such a policy, particularly in the Allegany Park where the practice of forestry must be coordinated with recreational and educational uses. Moreover, under normal forest conditions, the birds are the chief factor in the control of injurious insects.

From the purely economic standpoint, the Woodpeckers are the chief enemies of wood-boring insects and bark beetles. Their elimination would certainly result in an increase of these destructive insects. Only one Woodpecker, the Flicker, can be induced to nest in artificial bird boxes erected for it. The others must drill out their own homes in a dead stub or limb. The Flicker, since ants comprise a large part of its food, cannot be so great a destroyer of borers as the Downy and Hairy Woodpeckers. The removal of dead trees and limbs to any great extent would be certain to decrease or altogether eliminate the latter birds.

In the same way, the removal of old logs, stumps and windfalls with upturned roots would be likely to eliminate the Winter Wren, one of the most interesting birds and sweetest of singers in the Park. The removal of small dead birch stubs would destroy the

chief nesting sites of the Chickadees, birds which from both the economic and esthetic standpoints we cannot afford to lose.

Further than this the fire danger is not so great in the Allegany Park as in a coniferous forest. There are no signs of great destruction by fires in the past. Forest fires have occurred, as many fire-scarred trees and stumps show, but the forest floor, with its humus and splendid reproduction of woody plants, indicates that they have done but little damage. The area will be well intersected with roads and trails, and any fire that starts can be easily reached and extinguished in a comparatively short time.

Fungi, of course, will develop in old stumps and logs, and such fungi are now abundant in the region. But a fungus that starts in a dead log or stump is rarely if ever truly parasitic, or the primary cause of the death of a living tree. Species of such genera as *Pleurotus*, *Polyporus*, *Fistulina*, *Pholiota* and *Volvaria* grow on both living and dead trees, but when on living trees they grow only on dead portions that have been injured by some other cause. The most destructive parasitic fungi, such as the chestnut disease (*Endothia parasitica*), the white pine blister rust (*Peridermium Strobi*), and *Trametes pini*, do not normally start or develop in dead logs or trees, but on living ones. They may occasionally, however, persist on a tree they have killed, fruit there, and re-infect living trees. This danger is so slight as not to justify cleaning a Park area of all dead trees and stumps, if thereby valuable forest birds are driven away.

The practice of forestry within large recreational areas is desirable. Yet there are many nature lovers who are antagonistic to such an idea. There is opportunity in the Allegany Park to show that forestry can be practiced without destroying many of the natural conditions of the forest. Certain parts of the Park should be preserved wholly in the wild state. Thus we may use the Park as an example to the rest of the State and the entire nation where forestry, recreation and the preservation of wild life can all be developed harmoniously.

GAME BIRDS OF THE PARK AND THEIR FUTURE

Only two native species of game birds are known to breed within the Park. These are the Ruffed Grouse, known locally as Partridge, and the Woodcock. The first is quite common, and the second, while not common, is widely distributed. Both are reported to occur in fewer numbers than in former years, but both are more frequently seen here than has been my experience in any other part of eastern United States in the past fifteen years.

One or more species of Pheasant (*Phasianus*) is reported as having been introduced in various parts of the Park area, but I saw none. A small flock are reported this year in the Tunungwant Valley near Limestone, and others have been liberated in the Red House Valley, and perhaps other places. How successful their

introduction is likely to be, it is hard to say. I would strongly advise, however, that *only native species* be encouraged in the Park.

The Bob-white or Quail (*Colinus virginianus*) seems to be unknown in the region, not only now but also in the past. Probably the winters are too severe and the snow too deep for them to survive here. Wild Turkeys doubtless occurred many years ago. Ducks occur in suitable places, and some may breed within the Park. Good duck hunting is sometimes to be had in the Tunungwant Valley, near Limestone, particularly in years when there are heavy rains that increase the pools and bayous, but in other parts of the Park the occurrence of ducks is only casual.

Efforts should be made to conserve game birds in the Park, not only because of their educational interest, but also in order to insure good hunting there always. Probably the most effectual thing that can be done to accomplish this is the setting aside of one or more central areas as game refuges where no hunting at any time should be allowed. In other specified parts of the Park hunting under proper legal restrictions should be allowed and encouraged, as it is one of the uses for which the Park was created. (For a discussion of management of the wild life of the Park, see Adams, '21.)

The boundaries of the game refuge area should be well marked, and fenced with a single wire, not barbed. Any other sort of fence is unnecessary and liable to be harmful to game. Ruffed Grouse, in the fall, frequently fly about wildly where flocks are scattering and often kill themselves by flying against wires. In other regions, where areas have been fenced with a fine-mesh wire fence, supposedly cat- and dog-proof, many Grouse and some Woodcocks have been killed and injured by striking the fence. On such areas game birds have been greatly reduced in numbers by this cause.

The Park regulations regarding game should be strictly enforced. The majority of hunters will respect the laws, knowing that they are for their own good. It is not unlikely that a few will break laws when they can, particularly the law that prescribes the maximum number of birds that may be taken in a day or season. However, a few convictions with severe penalties will serve as a check for such disregard of law.

The use of the automobile in hunting has a bad effect in most regions. Hunters go from one good area to another with the machine, covering a larger territory in a day, and keeping their dogs always fresh. Complaint is made that this practice has been combined with a disregard of the daily bag limit, with decidedly bad results. The use of an automobile to reach the Park for a hunting trip is not objectionable, but its use in going from place to place there for the purpose of covering a greater area in a day should be restricted if it tends to result in depletion of game or other unfavorable features.

The aim should be to keep the game birds of the region always in normal numbers, and to allow only so much hunting as will offset their natural annual increase. If this can be done successfully there will always be good hunting in the Park. If it cannot, game birds

will decrease continually until it becomes necessary to stop hunting altogether.

To insure continual good hunting it should be part of the duties of some officials employed in the Park to keep careful watch of the relative abundance of game, and to report regularly to the Park Commission as to how the birds have withstood the hunting season and the winter, and how successfully they have reared young in early summer. Provision should be made by which the Park Commission should be empowered to stop all hunting for a year or two in case the numbers of birds has been greatly depleted through failure of food supply, too intensive hunting, or severe weather conditions.

Ruffed Grouse seem able to care for themselves through the winter, no matter how deep the snow or severe the cold. There will probably be no necessity of feeding them or taking special care of them through that season. The great numbers of deaths in winter are more likely to be due to natural enemies. The carnivorous mammals that are active through the winter and that prey upon Grouse when they have opportunity are not numerous in the Park and will probably not be a serious danger to game. The enemies that may cause considerable depletion in numbers are the Goshawks and Horned Owls that in certain years invade more southern regions from the north, probably only when the food supply there is scarce. These birds are also liable to affect the numbers of small game mammals such as the varying hare. The time of their invasions should be carefully observed. Correspondence with field ornithologists in different parts of the country will reveal the coming southward of such birds. In case of necessity it may be advisable to employ a hunter in such years to decrease these predacious birds, particularly within the game preserve areas.

The question of other natural enemies of game is not particularly serious. The balance of nature, discussed elsewhere, applies here, and it must be remembered that extermination of the fox, lynx, skunk, mink or weasel may result in some unforeseen condition that in the end would be more harmful than beneficial to game and other wild life of the Park.

The introduction of other species of game birds to the Park area deserves consideration. As has been said, the Bob-white or Quail seems never to have been native in the region, probably because the winters are too severe and snow too deep. This bird must have grain or seed foods, and grit with which to digest them; and deep snows, particularly crusted snows, often decrease their numbers in regions where they are native. They could probably not be introduced successfully unless provision were made to feed and care for them through the winters, involving considerable expense. Attempts to introduce this species seem therefore inadvisable.

Pheasants and other foreign species may perhaps be successfully introduced. It must be remembered, however, that the introduction of a foreign species in numbers enough to make good hunting will

cause a change in the balance of nature, and will affect some native forms of wild life. This adverse effect will likely apply to the Ruffed Grouse itself, and the question will then be as to which species is more desirable, the native Ruffed Grouse, or the foreign Pheasant. The Pheasant is a beautiful and interesting bird, but it is doubtful if its shooting affords as much real sport as the Ruffed Grouse. The real sportsman measures his success more by the difficulties he has overcome and intricate shots he has accomplished successfully than by the size of his game or the number secured. It would be better, therefore, to put time, money and effort into protecting and conserving the native Ruffed Grouse, than in introducing the foreign Pheasant or other exotic species.

While there is good ground for objection to the introduction of foreign game birds, there ought to be none to the introduction of species formerly native in the region. The Wild Turkey undoubtedly occurred here many years ago. I am not aware that any attempt has ever been made to introduce this species as a game bird in regions where it was formerly common. It is now rare in most regions to which it was indigenous, and perhaps is in danger of extermination. Its preservation for the future should be of as much value and interest as the preservation of bison and elk. It might be difficult, and undoubtedly would be expensive, to obtain a stock of these birds. The stock should be obtained from a region as nearly like the Park as possible, one where there are deep snows in winter, that the birds may be accustomed to living through a hard season. Perhaps such conditions will be found in the higher parts of the southern Appalachians. The birds should of course not be hunted for many years, or until their introduction has proved wholly successful. The food habits of the Wild Turkey should be studied, particularly through the winter, and the birds fed when necessary during the first few years at least. There is as much reason to expect the introduction of this bird to be successful as that of the Pheasant; and to the American nature lover its re-establishment in its former haunts should be of great interest and a source of just pride.

The formation of lakes in the Park, aside from their many other attractive features, will undoubtedly increase water birds, and it is quite possible that some duck hunting will be available where there is now none. Many migratory species of ducks, Canada Geese, and even occasional swans are reported to occur along the Allegheny River in the fall. Lakes will invite these birds to stop during migration. Water plants and aquatic life that will furnish food for these birds should be encouraged, and perhaps introduced if they do not establish themselves naturally.

With the creation of lakes and ponds it would seem quite possible to establish the Black Duck, and perhaps the Mallard, Blue-winged Teal and Wood Duck as breeding birds in the Park. For such a result the lakes must not be too much of the artificial reservoir type, but the growth about their shores of natural grasses, sedges, and swamp-loving shrubbery and plants should be encouraged. Leaving

a few dead, hollow trees or stumps, or the erecting of artificial substitutes for nesting sites would be likely to attract the beautiful Wood Ducks.

In considering this matter it might be advisable to locate the wild life and game preserves in places where lakes can be created, and plan for the construction of such lakes. This will protect not only ducks and water birds that may breed, but also give the migratory species a place to tarry unmolested, increase the numbers that will habitually stop in the region, and make good hunting each fall on lakes where shooting is allowed.

WHEN AND WHERE TO STUDY BIRDS IN THE PARK

One who visits the Allegany Park with a study of its birds as one of his objects will do well to go early in the summer. Most birds are nesting and singing in June and early July, and are easily observed then. By the middle of July several species have ceased to sing. Fewer and fewer songs are heard as the summer advances, until by mid-August nearly all birds are silent. The number of bird species seen is likely to be much greater in June and July than later in the summer.

In late summer many birds moult, acquiring the plumage of fall and winter, which is often dull and not so distinctive as the breeding plumage. Large numbers of young birds in plain but puzzling plumages are to be found then. These facts make identification of birds at that season a matter of considerable difficulty, until one becomes skilled through long practice. The chapters on Identifying Birds in the Field and the Field Key (pages 334-345) give ample guidance for the amateur and should enable anyone to distinguish and become well acquainted with most of the Park birds in a reasonable time. However, identification is only one of several aspects of this pastime; the interesting habits of birds and their ever attractive manners make them extremely fascinating at all seasons.

The best time of day to look for birds is in the morning, the earlier the better. Birds begin their day with the first faint light of dawn, and are most active in the early hours following. Near noon they are inactive and silent, as a rule. The expedition that waits till nine or ten o'clock to go out into the field will find comparatively few birds. There is another period of bird activity toward evening. One may often be quite successful in finding birds in the last hours of daylight; and as twilight deepens such night-calling species as the Whip-poor-will and owls become vocal.

Trips into the field to look for birds are best made on foot and in small parties of two or three persons. The automobile may be useful in getting from one locality to another, but one will see few birds that can easily be identified from a moving car. Walking is greatly to be preferred; not the rapid hike that covers as much ground as possible in a given time, but slow sauntering, stopping wherever the beauties of nature invite one to tarry. Often one who saunters over a small area finds as many birds as one who covers

many miles, and nearly always acquires a more intimate acquaintance with the birds he has seen. Furthermore, walking out of doors, especially with a definite object in view, is the best of healthful exercises.

The number of birds seen on a trip is usually in inverse ratio to the number of persons in the party. If too many wish to go on a trip it is better to divide into two or more small groups, going by different routes. A person will see the most birds when alone, although in some cases two pairs of eyes or ears are better than one. Quick motions, loud conversation or laughter, and sudden exclamations, all tend to keep the birds away from the party and lessen the opportunity to use one's eyes and ears to locate them.

A field glass of some sort is almost indispensable in observing birds, particularly for the beginner. The glass brings out the slight details of shape or plumage that are so necessary in making the more difficult identifications. An opera glass is good, but a glass of higher power is better. Most observers prefer, for ordinary field work, a prism glass of six or eight diameters. Higher power than this can be used for water birds along a seacoast or large lake, but ordinarily is not necessary. The higher the power the more difficult it is to hold the glass steadily on the object in view. For this reason many prefer six diameter glasses to eight.

One who wishes to do serious work should have a note-book for descriptions of new birds to be written on the spot. Not only descriptions, but notes on habits, song, associations and other facts will prove interesting and valuable, and most pleasant winter reading withal. One should never neglect a given species of bird because he already has seen it satisfactorily and has its name on his list. The test is not how many birds you have seen, but how many birds you know intimately. The possibilities of observing something new about even our commonest birds are never exhausted. And with each returning spring there is ever fresh interest in even the plainest birds and the most familiar songs.

In Allegany Park the birds are to be found almost anywhere. Wherever natural conditions have not been greatly changed this is especially true. As a rule birds are more abundant near water than on high ridges at a long distance from streams or lakes; and in general, are more frequently met with in the open or about the edges of forests than in the midst of dense woods. Areas near civilization where too much underbrush has been removed, park-like groves of trees without shrubbery, will never have many birds. Except for these general rules there are no special places where birds abound in preference to all other localities, but one should find birds almost anywhere that he looks for them. Local weather conditions or local abundance of food supply may cause birds to congregate in one locality for a day or two, but these conditions do not last, and cannot certainly be foretold.

A knowledge of localities, however, will help us to find certain species that we wish to see. These may have decided preferences as to habitat, governed by either the character of their food or of their

nesting sites. For this reason I have grouped the birds in the following chapters according to such favorite haunts. The observer will soon notice that certain birds are almost invariably associated, or always in a certain distinct environment, so that if one describes the place where a bird was found, that often forms a good clue to later identification. The best-known birds are those living about orchards, meadows or buildings, in the vicinity of man. They are less shy than other birds, and more easily observed. The beginner may start with these first, and as he gradually develops an intimate acquaintance with them he will enlarge the circle of his wanderings to the upland thickets, the stream valleys, and finally to the forest. In the thick tops of the forest trees observation is more difficult. The bird often hides itself most tantalizingly behind a screen of dense foliage. The rarer warblers flit incessantly, giving but brief glimpses of their brilliant colors. When the student finally has come to know not only the common birds of orchard and meadow, but also those rarer gems of the forest, he has developed a skill and enthusiasm in bird study that will lead him joyously to the wildest haunts in all weathers.

BIRDS OF ORCHARDS AND SHADE TREES

Many birds that live in or about trees prefer those that stand alone with open country about them, rather than trees in a forest. For this reason certain birds occur mainly in orchards or in and about scattered shade trees along roadsides. Most of these will be looked for in vain in forests, for the trees are too close together and the cover too dense for their liking.

Apple orchards (figure 74) are common in the Park, and about farms and along roadsides many large shade trees have been either planted or left from the original forest. Sugar maples (*Acer saccharum*) are the commonest shade trees, but there are also elms (*Ulmus americana*), red and silver maples (*Acer rubrum* and *A. saccharinum*), white and red oaks (*Quercus alba* and *Q. rubra*), butternuts (*Juglans cinerea*), basswoods (*Tilia americana*), shagbark and pignut hickories (*Hicoria ovata* and *H. glabra*), Norway and black spruces (*Picea excelsa* and *P. mariana*), and scattered individuals of other species.

About these scattered trees the vegetation is mainly that of the meadows and open fields, though some grasses or plants that grow well in the shade, such as orchard grass (*Dactylis glomerata*), are in greater abundance than others.

In addition to the birds here listed as living in such localities the following species may also be found in summer in orchards or about shade trees: Mourning Dove, Sparrow Hawk, Ruby-throated Hummingbird, Phoebe, Blue Jay, Crow, Starling, English Sparrow, Red-eyed Vireo, Yellow-throated Vireo, Redstart, House Wren, White-breasted Nuthatch and Chickadee.

ROBIN. *Planesticus migratorius migratorius* (Linn.)

The Robin is so common and well known that a description of the bird would seem hardly necessary. Yet I have found that few people can describe a Robin correctly. The bird is about ten inches long, gray on the upper parts, becoming almost black on head and tail, particularly in the male. The throat is streaked black and white, and the breast a brownish red. The under parts are white, and the outer tail feathers tipped with white. Young birds have breasts spotted like those of the true thrushes, and backs streaked with whitish.

Robins are abundant in the Park, as they are in this general northern region. They are found in orchards and about buildings, but are seldom met with in the forest, particularly in the denser parts. While this species is common, I believe it is by no means the commonest bird of the Park, as at least three others, the Song Sparrow, Red-eyed Vireo and Indigo Bunting, exceed it in abundance.

The song of the Robin is a lively, sweet carol, made up of short phrases of two or three notes each. In the early morning the bird sings these phrases rapidly, one after the other, without pause sometimes for as much as fifteen minutes at a time. When singing later in the day there are not only short pauses between the phrases, but the phrases themselves are grouped together in fours and fives, with longer pauses between the groups.

The nest of the Robin is placed in a great variety of locations. The bird prefers a broad, nearly flat surface on which to place the nest, and also likes shelter from above. In a tree, a broad flat limb or fork of rather large limbs is commonly chosen. The bird likes to make its home about buildings, placing the nest on rafters or beams, or under piazzas, roofs or bridges. The nest is made of mud and grasses, and the eggs are light greenish blue in color, well known to every dweller in the country.

KINGBIRD. *Tyrannus tyrannus* (Linn.)

The Kingbird is a little smaller than the Robin, with dark gray upper parts, the head almost black, the tail black with a broad white band across the end, and the under parts pure white. The white tail band is the best field mark, as no other bird has the tail marked just this way. On the crown of the head is a patch of orange, concealed under the dark gray tips of the feathers, but, despite the colored plates that always make this mark prominent, it rarely shows in a living bird.

The Kingbird is common in the Park, occurring about orchards and shade trees, wherever there is open country, with scattered trees, posts or wires to serve as vantage points. It perches in a conspicuous place near the top of a tree, whence it darts out and snaps up the flying insects that pass, or gives chase to a Crow or Hawk that comes too near. In the latter case the larger bird always retreats, for the Kingbird will fly above it, and repeatedly dashing downward, peck feathers from its back, or even alight on its back and ride a little way if it has the opportunity.

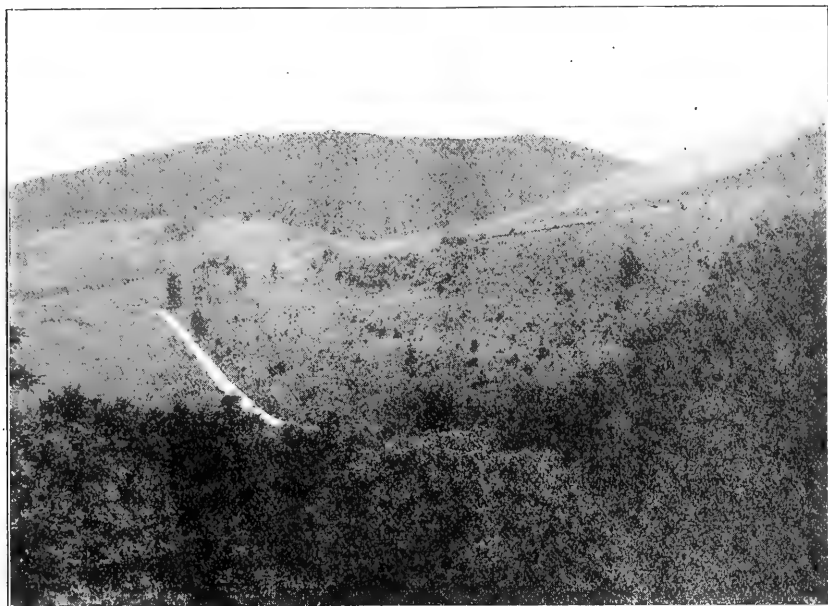


Fig. 71. Quaker Run Valley; showing tree-tops in foreground, with edge of meadows, upland pastures and forested slopes in the distance.



Fig. 72. Allegheny River, near Tunesassa. Frequented by the Spotted Sandpiper, Killdeer, Kingfisher, Great Blue Heron, and occasionally Black Ducks, Herring Gulls and Bald Eagles. Mountains of State Park in the distance.



Fig. 73. View across Quaker Run and up Cain Run valley, showing a great variety of bird haunts. Pasture and stream margin trees in foreground, tilled fields and orchards beyond, and unbroken forest on the heights.



Fig. 74. An apple orchard, where such familiar birds as the Robin, Bluebird, Kingbird, Chipping Sparrow, Flicker and Downy Woodpecker are sure to be found.

The Kingbird's voice is high-pitched and harsh. It has no song, but its commonest notes sound like "keep-keep-kip kipa kipa kipa kip," emitted rapidly. The nest is built in a tree, preferably an apple tree in an orchard or a shade tree overhanging a stream. One or both parents are usually perched near the nest, guarding it from all intruders. The eggs are a beautiful creamy white, with rather large, elongated spots of reddish brown and lilac.

CHIPPING SPARROW. *Spizella passerina passerina* (Bech.)

This bird is smaller than the English Sparrow. The top of the head is bright chestnut or reddish brown, bordered by white lines over the eyes and black lines through them. The back is grayish brown streaked with black, with bars in the wings, and the under parts are light gray without marks. Young birds lack the bright crown and are striped on the breast.

The Chipping Sparrow is a common bird in the orchards and scattered shade trees of the Park. It is often an exceedingly tame and familiar little bird. It may occur about the edges of the more open forest, but is unknown in dense woods.

The song is a simple trill of rather unmusical quality. It varies in individuals mostly in time, some songs being slow enough to count the separate notes easily, but others so rapid that these notes cannot be counted. The song is usually all on one pitch, but occasionally there is a slight rise or fall.

The nest is placed in a tree, bush or vine, often in the tangle of a porch trellis. It is made of small twigs and grasses, and lined with horsehair. The blue eggs are marked with blackish spots near the larger end.

GOLDFINCH. *Astragalinus tristis tristis* (Linn.)

This little bird is smaller than the English Sparrow. The male is brilliant yellow, except the wings, tail and top of the head, which are black. There is a bar of white in the wing and a few white tips on the tail feathers. The bill is bright orange. The female is dull olive color, somewhat yellowish beneath and with prominent wing bars.

The Goldfinch is abundant in the Park, inhabiting orchards and shade trees, and in smaller numbers the margins of thickets. The birds may be seen in small flocks in early summer and in pairs later. They feed commonly on seeds of the canada thistle, dandelion and other plants of the composite family. They fly from place to place with a distinctly undulating flight.

The song of the Goldfinch is bright, pleasing and canary-like. It is quite varied, a single bird commonly singing a dozen or more different variations, one after another. In spring the birds sing together in flocks, but this is not a common habit in summer. The song season continues well into August, when most other species have ceased to sing. The call notes are "cher-wichery, cher-wichery," given with each undulation in flight, and "swee-see-ee" with an upward inflection to the second note. Both these calls are frequently interpolated in the song.

Goldfinches are late home builders, seldom starting before July. The nest is placed in a tree or bush, the bird showing a preference for maples. It is a cup-shaped structure, largely made of thistle down. The eggs are very pale blue or nearly white.

BLUEBIRD. *Sialia sialis sialis* (Linn.)

The male of this beautiful bird, which is a little smaller than the Robin, is brilliant blue on the upper parts and reddish brown on the throat and breast, shading to white beneath. The female is duller, grayer blue, and lighter reddish brown on the breast. Young birds are gray, with a glint of blue in the wings, the upper parts streaked with whitish and the breast spotted with brown.

The Bluebird is quite common in the more open portions of the Park, about farm lands, orchards, shade trees and buildings. It may be observed sitting on wires, posts or open perches along the roads, when the curious manner in which it hunches its shoulders, as it watches the ground, will identify it as readily as its plumage.

The voice of the Bluebird is soft, low-pitched and sweet. The common call note, which has been written "surely" or "truly" but is perhaps more accurately "oahloo," is as sweet as the song. The latter is a longer, more varied performance, sung mainly in early spring and only occasionally in the early summer months. "Eeo-ah loo-ee," with a sweet, upward inflection on the last note, will represent one of the commonest phrases.

The nest of the Bluebird is placed in a hole in a tree, stump or fencepost, or in a bird box provided for it. It is a bird that could be easily attracted about the farms or the more open camp sites of the Park by the erection of such boxes or suitable nesting holes. The nest is made of grasses and hair, and the four to six eggs are very light blue, without marks.

BALTIMORE ORIOLE. *Icterus galbula* (Linn.)

This beautiful bird, a little larger than the English Sparrow, is colored a brilliant orange and black. The head, neck, throat, upper back, wings and tail are black. The breast, under parts, lower back and shoulders are orange. The wing is marked with white bars. The female is duller, brownish or olive and dull orange replacing the male's more brilliant colors.

This bird is well distributed in shade trees and along stream borders in the Park. It is particularly partial to the elm tree, when nesting, but may also be found nesting in other kinds of trees. It lives mainly in tree tops and is seldom seen low down in the trees or on the ground.

The song is a loud, rich whistle. A single note, "whewtle" or "whewlee," the first with a fall in pitch, the second with a rise, is often uttered. The longer song consists of these two notes, and some others, repeated and put together in a variety of combinations.

The nest is a deep, pouch-like structure, hung from the low outer branches of an elm or other shade tree. The nest is woven of strings or plant fibers, those stripped from last year's stalks of Joe-Pye weed

being a favorite. It is lined with horsehair. The eggs are marked with fine irregular crisscross lines, that make them appear as though cracked. In July, young Orioles that have tumbled from the nest and are still unable to fly well, may be found. They are quite noisy, and if they escape marauding cats, will be fed by the parents till able to care for themselves.

CEDAR WAXWING. *Bombycilla cedrorum* Vieill.

This bird, a little larger than the English Sparrow, may be easily distinguished from all other summer birds of the Park by the crested head, soft brown, gray and yellowish plumage, the black about its eyes and the yellow band across the end of the tail. The red wax-like tips of the wings are not present in all individuals. Young birds show a whitish mark over the eye, but at first lack the black eye patch, and their breasts are streaked with light brown. The soft smooth plumage of this bird makes it, while not particularly brilliant, one of the most beautiful of American birds.

The Cedar Waxwing is quite common in the Park. It inhabits orchards and shade trees, but is also found to some extent along stream borders, and about the edges of thickets and forests. It lives in the trees and bushes, and is easily observed in wild cherry trees when the cherries are ripe and it is gathering them for itself and its young.

This bird is songless, having usually but a single long whine-like note, rather high-pitched and faint. Mr. Silloway describes another note, a loud screech produced by a wounded bird. I once captured a bird that had broken its wing against a wire, and as I caught it, it gave the same frightened cry.

The nest is built in a bush or tree, rather later than most species, nesting being at its height in August. The young are fed largely on cherries and smaller berries, the parents carrying these to the nest in their throats, and ejecting them one at a time when feeding the young (cf. Herrick, 1905, pp. 86-102).

BRONZED GRACKLE. *Quiscalus quiscula æneus* Ridgw.

The Grackle is a little larger than the Robin. It is entirely black, with rich, metallic reflections of purple, bronze and green. It may be known from other Blackbirds by the larger size and the long tail, in which the middle feathers are longest. This tail, when spread in flight, is shaped like the keel of a boat. The female is a little smaller and duller than the male.

The Grackle is fairly common in and about the Park, nesting in shade trees and orchards and feeding largely in the open meadows or along the shore of the river. It is likely to be in small flocks even when nesting, and several nests are often built in the same tree. It walks rather than hops, as do all the Blackbirds.

The voice of the Grackle is always harsh. The common call is a "chack" similar to that of the Red-wing. In spring the birds utter harsh, raucous notes that evidently serve as a song.

The nest is a large, bulky structure, placed in a tree. Evergreen trees are preferred, particularly planted spruces; but apple trees, maples and various others are used where evergreens are not to be found.

NORTHERN FLICKER. *Colaptes auratus luteus* Bangs

The Flicker is easily distinguished from other birds in many ways. It is larger than the Robin, with a brown back, barred with black and marked with a patch of white above the base of the tail which is conspicuous in flight. There is a red crescent-shaped patch on the back of the neck and a similarly shaped black patch on the front of the breast. The under parts are buff color and spotted with black. As the bird flies past, with the characteristic undulatory flight of a woodpecker, the yellow wing linings flicker, reminding us of its common name.

This bird is common in the Park, mainly in orchards and among shade trees, but also in trees along the stream margins and in the forests, preferring those that are more open. It frequents trunks and limbs of trees, and is found also on the ground, a habit not common with most Woodpeckers. Ants, which it gathers when on the ground, make up a large part of its food.

The notes of this woodpecker are varied. In the spring and early summer it gives a long call, "wick wick wick wick," repeated many times, either all on one pitch, or gradually rising and falling at the beginning and end. A common call is "keeyah," slurring downward; and a third note, produced in the courtship performance in spring is "oo-eka, oo-eka, oo-eka." The bird also drums on dead limbs like other Woodpeckers.

The nest is in a hole in a dead limb or trunk of a tree, or drilled in a telephone pole. Several nests were located in the Park. They may be known by the size of the opening, too large for any other woodpecker, except the Pileated, and too small for that bird.

DOWNY WOODPECKER. *Dryobates pubescens medianus* (Swain.)

This is the smallest of the Woodpeckers. It may be distinguished from the Hairy Woodpecker mainly by size, but also by the black bars on its outer tail feathers. From the Sapsucker it may be told by the continuous white back, and in the male, by the small red spot on the back of the head. The wings are spotted with white, but without the broad white patch of the Sapsucker.

Downy Woodpeckers are common in the Park, frequenting orchards and shade trees, and are also found in trees of the stream border and in the forests. In the latter place they are less common than the Hairy Woodpeckers.

The common call of this Woodpecker is a sharp, high "keep" similar to that of the Hairy Woodpecker, but not so loud. Another call is "he-he-he-he-he" descending in pitch and entirely distinct from the rattle-like call of the Hairy Woodpecker.

The nest is like those of other Woodpeckers but the entrance is smaller in size. The nesting hole with its round opening is exca-

vated in the trunk or limb of a dead tree. Young birds, out of the nest, were observed in the Park.

WARBLING VIREO. *Vireosylva gilva gilva* (Vieill.)

This bird, smaller than the English Sparrow, is plain dull grayish green above, without wing bars, and plain white tinged with yellow beneath. The lack of wing bars distinguishes it from all Vireos but the Red-eye. The greenish top of the head and more yellowish sides separate it from that bird, and also from the Tennessee Warbler.

It is not common in the Park, and it occurs mainly in trees along the stream valleys, or high up in maple and elm shade trees. Only two birds were observed in the Park itself, one on Quaker Run and one in the Tunungwant Valley. Several were noted in the shaded streets of Salamanca and in trees along the river near that city.

The song of the Warbling Vireo identifies it better than the plumage. It is a sweet warble, of usually ten to twenty notes, varying in pitch, but seldom with two notes together on the same pitch. The song is continuous and rapid, all the notes being linked together. Every fourth or fifth note is slightly accented, and the song frequently ends on a high-pitched, accented note. It resembles the Purple Finch song somewhat, but a good ear will easily distinguish it.

The nest is a pocket-shaped structure of bark, hung from a forked limb of a tree. It is quite similar to the nests of other species of vireos, but averages a little shallower.

LEAST FLYCATCHER. *Empidonax minimus* (W. M. & S. F. Baird).

This little bird is considerably smaller than the English Sparrow, and the smallest of the flycatchers of the Park. It is marked much like the Wood Pewee, but is somewhat greener on the back, smaller in size, and with a shorter wing. In distinguishing these two birds in the field the notes are more reliable than the plumage.

The Least Flycatcher is rather rare in the Park. A few were met with south of Salamanca, an occasional individual on Quaker Run and in the Red House Valley, and one bird on Limestone Brook. All were either in apple orchards or in shade trees along the roadside, and this is the favorite habitat of the species.

The song of this bird, if it may properly be considered a song, is very simple, and not musical. It consists of a sound like "chebec, chebec, chebec," repeated over and over, now slowly, now rapidly; sometimes only four or five times, then again for a long time at a stretch, without rest. Since the sound is heard mainly in spring and early summer, it should probably be classed as a song.

The nest is a small cup-shaped structure, resembling those of the warblers, and placed in the fork of a tree, usually ten feet or more from the ground. Unlike those of the warblers, however, its eggs are pure white.

SCREECH OWL. *Otus asio asio* (Linn.)

This Owl is easily distinguished from all others by its small size and its ear tufts. No other small Owl has ear tufts. The color of the plumage is gray or reddish brown, the difference being individual, and not due to age, sex or season.

How common this Owl is in the Park it is difficult to say. Owls are not easily found, and the Screech Owl is more silent in summer than in spring or fall. None was heard, and only one seen,—a young bird that flew into a farmhouse on a tributary of Quaker Run the night of July 11. It was captured and kept until I saw it the next day, and then released.

The call of the Screech Owl is not a screech but a long, wavering cry, slowly grading downward in pitch toward the end. It is most commonly heard at night.

The Screech Owl nests in a hole in a tree, an old Flicker hole in an apple or shade tree being a favorite place. It lives most commonly in orchards or shade trees, but is sometimes found in the forest where it shows a preference for evergreen trees, among the branches of which it hides and sleeps in the daytime.

RED-HEADED WOODPECKER. *Melanerpes erythrocephalus* (Linn.)

Adults of this bird, which is about the size of the Robin, are easily known by the red head, the entire head, neck and throat being bright red. The broad black and white patches of the wings and back are also distinctive. Young birds have these patches also, but no red head. The head is spotted with brown, and the rest of the plumage is more or less brownish, and spotted or barred.

This bird is rare in the Park. One adult was seen along Quaker Run, July 11, and several adults and young were seen in the Tunungwant Valley, July 25 and 27. It prefers orchards, shade trees or open forest, but does not occur in dense forests. It may sometimes be seen on fence posts or telephone poles far from any tree.

The note of this woodpecker is a loud and guttural "ker-r-ruck," suggesting the rattle of the tree toad. It also produces the drumming noise of other woodpeckers. Unlike other woodpeckers, its flight is not always undulatory.

The nest is a hole in a dead limb or telephone pole, similar to those of other woodpeckers. The presence of young birds observed in the Park indicates that they nest there.

CRESTED FLYCATCHER. *Myiarchus crinitus* (Linn.)

This bird is a little smaller than the Robin. Its throat is gray, and its upper parts olive-brown, shading to a bright reddish brown in the wings and tail, which latter is conspicuous in flight. The breast and under parts are pale yellow, and the wings are marked with white bars and edges to the feathers.

The Crested Flycatcher is decidedly rare in the Park. I met with but two, one on Quaker Run, July 7, and one on Wolf Run, July 18. The bird prefers somewhat open country such as that afforded

by orchards and shade trees or rather open forest, as of chestnut and oak. Both birds which I noted were in the vicinity of orchards.

This species is songless, but at times is quite noisy. A common note is a high-pitched, clear whistle, "wheep," which is often followed by a lower and harsher "raa raa raa." The first note can be imitated, and sometimes in the mating season an imitation will bring the bird.

The nest is placed in a hole in a tree, or similar cavity. These birds sometimes nest in bird boxes and can be encouraged to stay in a locality by the erection of such boxes. The nest is constructed of grasses and roots, often with a piece of cast snake-skin added.

BIRDS ABOUT BUILDINGS

It is an interesting fact that a number of birds that formerly lived and nested under natural conditions, have found in the buildings and other structures of man conditions wholly suitable for their homes. These birds, to a greater or less extent, have changed their manner of nesting and now are found more commonly about houses, barns, sheds, bridges and similar structures than in their former natural habitats.

Very rarely now do the Barn Swallow and Chimney Swift nest in their old natural way in caves or hollow trees. In eastern United States this is also true of the Cliff Swallow, whose other name, Eave Swallow, is here more fitting. In a way, it might be appropriate to create another ecological classification, "Birds of the Air," and include all the Swallows, the Chimney Swift and the Nighthawk. It is only the character of the nesting site that makes them birds of buildings, their food consisting almost entirely of winged insects obtained from the air.

In addition to the species here listed, the Flicker, Nighthawk, Tree Swallow, Robin and Bluebird may also sometimes be classed as birds about buildings.

HOUSE WREN. *Troglodytes ædon ædon* Vieill.

This bird is much smaller than the English Sparrow. The upper parts are plain grayish brown, barred on the wings and tail with black. The under parts are grayish white without distinctive markings. While it has no very distinctive marks this bird is easily known from other small brown birds such as the sparrows, by its barred rather than striped plumage, and its sharp, slightly curved bill.

The House Wren is abundant about the farm lands of the Park, being found in old orchards and about buildings, where it keeps up an active search for small caterpillars and other insects that form the bulk of its food, the male singing incessantly.

The song is a succession of short, rapid notes, usually beginning with a few low-pitched ones, then suddenly bursting out in an almost explosive manner, with notes that are higher and louder, then falling again in pitch to its termination. It is sung frequently, all

through the period of nesting and feeding the young, from daylight to dark. Until one comes to appreciate it as does the bird lover, its repetition may seem monotonous.

The Wren places its nest in some crack or crevice of a building, in a hole in an apple tree, or in a bird house especially provided for it. It carries to such a place a mass of sticks and feathers, and here brings up a rather large family of six to eight young. The birds work tirelessly when gathering food for their brood.

This is a bird which can easily be attracted to suitable parts of the Park, about farm buildings and orchards, by the erection of bird houses. Houses with an entrance of one inch diameter will suit the Wren, but will be too small for the English Sparrow. This bird may not be entirely desirable in all cases, for some individuals have a bad habit of destroying the eggs of birds larger than themselves by piercing them with their sharp bills, an act which seems in many cases to be purely malicious.

BARN SWALLOW. *Hirundo erythrogastra* Bodd.

Swallows are easily distinguished from all other birds, save the Chimney Swift, by their long pointed wings and swift flight. Their forked tails, brighter colors and different manner of flight distinguish them from the Swift. The Barn Swallow may be distinguished from its relatives, whether in flight or perching, by the deeply forked tail, the outer feathers being fully an inch longer than those of other Swallows.

This Swallow is common and widely distributed in all open country in the Park, being commoner than any other, unless perhaps the Cliff Swallow, which is a bird more local in distribution but decidedly outnumbering the Barn Swallow in several localities. Barn Swallows may be commonly seen in the Park, flying swiftly about in open country, now high in the air, now darting and skimming low over water or meadows. As a rule they choose a wire for perching, but young birds often perch on the roof of a barn or on the dead branches of a tree top, where they wait for the approach of the parents with food.

The song of the Barn Swallow is a long pleasing twitter, not unmusical, and usually uttered in flight. Its quality best distinguishes it from the twittering of other swallows. The time and pitch are decidedly variable.

The nest of this swallow is placed on a beam or against a rafter, inside a barn loft. It is made of mud and straw and lined with feathers. Young birds may be seen out of the nest in July. The parents continue to feed them for some time after they leave the nest. This evidently is a habit with all swallows, probably because it takes time and practice for the young to become adroit enough on the wing to catch their own food.

CLIFF SWALLOW; EAVE SWALLOW. *Petrochelidon lunifrons lunifrons* (Say)

This bird may be distinguished from the Barn Swallow, the only other with dark blue and chestnut coloration, by the less deeply-

forked tail, the white forehead, which is easily seen when birds are perching, and the salmon-buff patch on the lower back, which is readily discerned in flight. Young birds also have these distinguishing marks, but lack the chestnut-colored throat. When they are perching breast forward the gray throat suggests a Rough-winged Swallow, and the other marks must be carefully looked for.

Like the Barn Swallow, this species is mainly a bird of the air, but is found about barns and perched on wires. It is locally exceedingly common in the Park. Colonies nest in the Red House Valley on lower Quaker Run, and west of Limestone, in the latter place outnumbering the Barn Swallow at least ten to one. I did not observe it near Salamanca.

The twitter of this Swallow is similar to that of the Barn Swallow, but in a peculiar squeaky voice that at once identifies it.

Nests are placed in colonies under the eaves of a building, most often an unpainted barn. In some localities the birds build against the rock faces of cliffs, but no such colony was seen in the Park. The nests are constructed of mud, and are retort-shaped, and lined with grass and feathers. Frequently the parents occupy the nest together, when the heads of both may be observed side by side at the opening. The fledglings often return to the nest after they have left it once, a habit rare among birds.

CHIMNEY SWIFT. *Chatura pelagica* (Linn.)

This dusky bird could only possibly be confused with the Swallows. From these it is distinguished by the rounded rather than forked tail, the dark under parts, nearly as dark as the back, the habit of never perching, and rarely resting anywhere save inside of a chimney, and the distinctly different flight. What the difference in flight is, is hard to say. It has always seemed to me that it beats its wings alternately, but the swallow both together.

The Chimney Swift is quite common in the Park, flying about here and there in the stream valleys, and frequently dropping into an old open-topped chimney. Often, in the midst of the forested areas far from any buildings, I heard the notes of these birds flying above the tree tops. This led me to think that they may still nest in hollow trees somewhere in the Park area. It might well be, for the bird is quite common, yet the open-topped chimney it prefers is now rather rare.

The notes of this bird are a loud, rapid series of "chips," sounding like "chip chip chipper chipper chipper chipper chip," usually produced when several birds are flying about in company.

The nest placed on the inside of a chimney is bracket-shaped and built of twigs, fastened together and to the chimney wall by the glue-like saliva from the bird's mouth.

ENGLISH SPARROW; HOUSE SPARROW. *Passer domesticus* (Linn.)

This well-known but little-esteemed bird is about six inches in length. The male is marked with a broad stripe of rich chestnut-brown on the sides of the head, and a patch of the same on

the shoulders. The top of the head is gray, the under parts are plain grayish white, the throat and upper breast marked with a broad patch of black. The female is plain dull grayish brown, without chestnut-brown marks or black breast mark.

The English Sparrow, introduced into America in 1850, and especially common everywhere about cities, is abundant in many places in the Park, staying about farm buildings. It is not found far away from buildings, however.

It has no song, but utters a large number of loud, rather harsh, chattering noises, and flocks of the birds keep up an incessant clatter.

The nest is a mass of grasses or twigs, lined with feathers. It is placed in any crack or crevice of a building, occasionally in a hole in a tree, and sometimes on top of a horizontal limb, in which case the nest is arched over with the entrance in one side.

PHŒBE. *Sayornis phæbe* (Lath.)

The Phœbe is a little larger than the English Sparrow and plain grayish brown on the upper parts, darker on the head, and grayish white beneath. There are two faint, light wing bars. While the bird has no very distinctive marks or colors, the flycatcher shape, with rather large head, and the habit of sitting still on a perch,—flirting the tail at intervals,—will distinguish it from all except Flycatchers; while the size well separates it from the larger King-bird and Crested Flycatcher, and the smaller Wood Pewee and Least Flycatcher.

The Phœbe is a common bird in the Park, being found mainly near buildings or bridges, in open country. It frequents orchards and shade trees, and likes the vicinity of water where small flying insects abound. Sometimes it is seen near rocks that afford it nesting sites. Several pairs were nesting and feeding young at Quaker Bridge, and it was noted in all the valleys near farm buildings, but did not seem to be common about Limestone.

This bird, though a flycatcher, may be said to have a song. It is a simple one, consisting of the syllables "Phebe—peeree—phebe—peeree" repeated at intervals, the "phebe" with the second note lower in pitch than the first, while the "peeree" has the second note higher and somewhat burred in quality. At times this song is sung in flight, when the bird prefaces it with a loud, rapid "pit pit pit pit pit" as it launches into the air.

The nest is built on a beam or rafter of a building, or underneath a bridge, or sometimes on a shelf against the face of a rock. It is made of mud, lined with hair, and covered with moss on the outside. The five or six eggs are pure white. A rock nest of this bird was discovered along the track of the Pennsylvania Railroad below Wolf Run.

STARLING. *Sturnus vulgaris* Linn.

This bird is a little smaller than the Robin. Adults are iridescent black in color, the feathers tipped with buff in fresh fall plumage,

which gives the bird a speckled appearance in fall and winter. The tips wear off, until the bird is nearly solid black by spring and summer. The bill in summer is bright yellow. Young birds in first plumage are plain grayish brown. This bird may be distinguished from the blackbirds by the long, pointed yellow bill, short tail and more pointed wings. In fall and winter when the bill is black the speckled plumage will identify it.

The Starling is not at this writing a common bird in the Park. It was introduced from Europe in the vicinity of New York City, and from that point is spreading about the country, but is evidently not yet numerous in the western part of New York State. I noted a single flock of these birds numbering eighteen in a field near Limestone. It is probable that they will increase steadily in numbers, and their presence may constitute a serious problem. They inhabit orchards, shade trees and the vicinity of buildings and open fields, but will probably never spread to the dense forests of the Park.

They have a variety of calls and whistles. One performance is a rather squeaky "Phree phree phree," not particularly loud. Another is a loud, clear, whistled "whee-ew," slurred downward. Still another is "hoo wheet," a loud whistle resembling the call of the Bob-white, but higher in pitch, and delivered more rapidly. In addition to these, Starlings seem to have learned, since coming to America, to imitate calls of many American birds, the Wood Pewee and the Cowbird being favorites.

The Starling nests in holes in trees, bird boxes, or crevices about buildings. It will occupy old woodpeckers' holes or natural cavities in trees, showing a great liking for those in old apple orchards. These habits have caused it to displace, to some extent at least, the Bluebird and the Flicker. This is one of the reasons why this alien bird is undesirable. The nest is built of grasses, and several pale blue eggs are laid. Nesting begins in April and flocks of young birds may be seen out of the nest in late May.

BIRDS OF THE OPEN FIELDS

Open meadows and grasslands (plate 25 and figure 75) occur in the Allegany State Park, mainly in the valleys along streams (map 4). Probably no grass areas were naturally in that condition formerly, but they have been cleared of their original forest long ago. They occur to some extent on the hillsides, but since the soil there is poorer and more difficult to cultivate, such areas are smaller in extent, and often are left to revert slowly to original forest growth (figure 76).

The meadows are nearly all under cultivation; either hay or oats, corn, buckwheat and other grains and vegetables being raised. Cultivation seems to have increased rather than decreased bird life, and it is noticeable that there are more of the true meadow birds in cultivated hay fields than in wild ones.

In cultivated hay fields, the nesting ground of most of the true meadow birds, the principal species of plants are timothy (*Phleum pratense*), red top (*Agrostis alba*), tall fescue grass (*Festuca elatior*), meadow grass, (*Poa pratensis*), and pink clover (*Trifolium pratense*). Under wild or partially cultivated conditions, many species of weeds and other grasses occur. The commonest of these, in order of abundance are white weed (*Chrysanthemum Leucanthemum*), milkweed (*Asclepias syriaca*), black-eyed susan (*Rudbeckia hirta*), daisy fleabane (*Erigeron ramosus*), St. John's-wort (*Hypericum perforatum*), early goldenrod (*Solidago juncea*), buttercup (*Ranunculus acris*), velvet grass (*Holcus lanatus*), mallow (*Malva moschata*), self-heal (*Prunella vulgaris*), goldenrods (*Solidago patula*, *S. lanceolata* and *S. rugosa*), Canada thistle (*Carduus arvensis*), evening primrose (*Oenothera biennis*), clovers (*Trifolium repens* and *T. hybridum*), orange hawkweed (*Hieracium aurantiacum*), and quack grass (*Agropyron repens*).

The drier hillsides that are clothed with grasses show other species, poverty grass (*Aristida dichotoma*) and wild oat grass (*Danthonia spicata*) being the common grasses, and such weeds as cinquefoil (*Potentilla canadensis*) and hop clover (*Trifolium procumbens*) becoming common. Such areas have little bird life, only the Vesper Sparrow among the meadow birds occurring in them commonly. Probably the Prairie Horned Lark prefers such areas, but it is decidedly rare in the Park. Where rock outcrops occur on such open hillsides the Nighthawks will probably be found nesting.

In addition to the birds listed below, the following species will sometimes be found either feeding or nesting in open meadows and fields: Spotted Sandpiper, Killdeer, Mourning Dove, Sparrow Hawk, Crow, Red-winged Blackbird, Grackle, Starling, all the swallows, Robin and Bluebird.

VESPER SPARROW. *Poæcetes gramineus gramineus* (Gmel.)

The Vesper Sparrow is of about the same size as the English Sparrow. It is best distinguished in flight by the white outer tail feathers. When perching, the stripes on the throat and breast, the bay-colored patch on the shoulders, and the wing bars help to distinguish it.

The Vesper Sparrow lives in the open meadows and grain fields. It is quite common in all such places in the Park area. More than most of the meadow birds, it extends its range up to the grassy hillsides that have been cleared of their original forest for pasture land. It is less common here, however, than in the broad, flat meadowlands of the valleys.

The bird feeds on the ground and walks rather rapidly. It may often be seen in the middle of a road. It commonly perches on trees, posts and wires, and usually chooses such places to sing.

Its call notes are not markedly different from those of other sparrows. Its song is sweet and clear, and a little like the Song Sparrow's in form. Many beginners overlook this bird simply be-



Fig. 75. Meadow of timothy and other grasses. Haunt of Meadowlark, Bobolink, and Savannah and Vesper Sparrows.

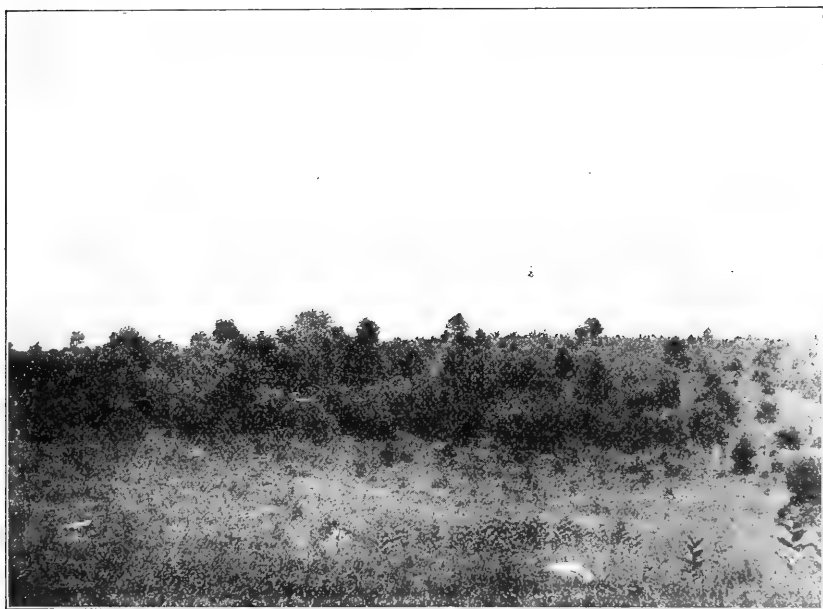


Fig. 76. An old field reverting to forest. Showing succession from environment of Meadowlark and Vesper Sparrow to that of such forest margin and thicket species as Field Sparrow, Indigo-bird and Chewink.



Fig. 77. Upland Thicket. Home of the Field Sparrow, Indigo-bird, Towhee, Brown Thrasher and Chestnut-sided Warbler.

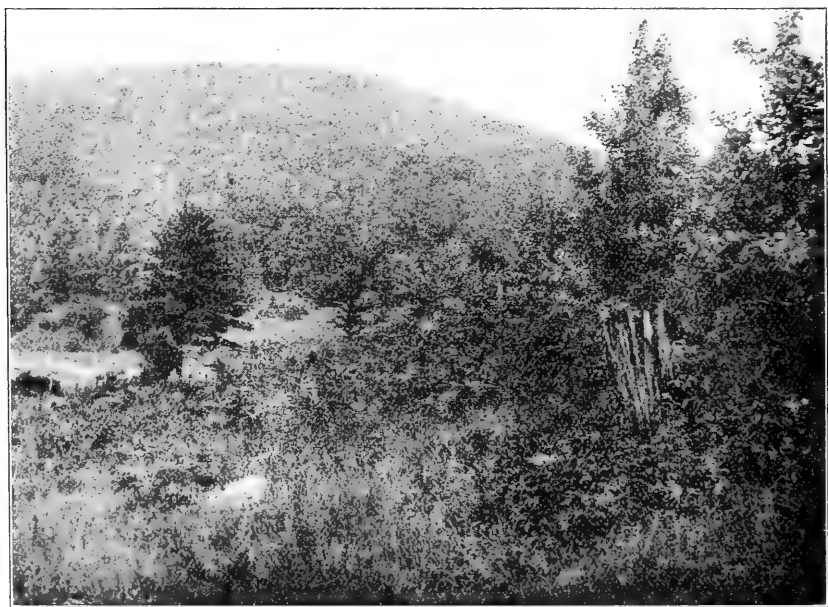


Fig. 78. Thicket encroaching on grassland of a hillside near Quaker Run, where one may find the Towhee, Field Sparrow, Indigo-bird and Brown Thrasher.

cause they mistake its singing for that of a Song Sparrow. The Vesper Sparrow begins with two or three pairs of long, sweet notes, each pair higher in pitch than the last, then terminates the song with a series of quick notes and trills that usually descend in pitch. While one can make no fixed rule as to how a Song Sparrow will begin its song, it is practically never with two pairs of long notes. The introductory notes, whether two, three or more, are short and quick, with pauses between them. Once this difference is learned it will always serve to separate the songs of these two birds in the field.

The nest of the Vesper Sparrow is placed on the ground in grassy places. No nests were found in the Park, but several young out of the nest were seen.

SAVANNAH SPARROW. *Passerculus sandwichensis savanna* (Wils.)

The Savannah Sparrow is a little smaller than the English Sparrow. It may be known by a narrow light line through the center of the crown, and over each eye a broader one, which is bright yellow in front of the eye. The breast is streaked and a few birds show a dark spot in its center like that of the Song Sparrow. Male and female are alike, and the young are marked in the same way.

This little bird is common in the meadows of the Park. It lives in the tall grass, and rarely perches higher than the top of a fence post or, more frequently, a tall weed.

It delivers its song from such perches. The song is weak and insect-like in quality, a fact which will distinguish it from all sparrows save the Grasshopper Sparrow. While there is some variation, the syllables "zip, zip, zip zee-e-e zee-e-e" will fit the majority of songs. The two "zees" are on different pitches, but which one is higher is a matter of individual variation. The Grasshopper Sparrow, which is a much rarer bird than this one in the Park, usually sings but a single "zip" and one long "zee-e-e-e." Its voice is less musical and even more insect-like than that of the Savannah Sparrow.

The Savannah Sparrow's nest is placed on the ground amid the grasses of a field, and is difficult to find, unless by accident, when one almost steps on it. In such cases the sitting bird slips out from under one's feet, and runs off through the grass with motions more like a mouse than a bird.

MEADOWLARK. *Sturnella magna magna* (Linn.)

The Meadowlark is about the length of the Robin, with a rather short tail. Its upper parts are brown, striped with black and light buff. The outer tail feathers are marked broadly with white patches which are conspicuous in flight. The throat and breast are yellow and crossed by a broad V-shaped black mark.

The Meadowlark is abundant in all meadow areas of the Park and may be easily seen and heard. It is a bird of the ground largely, walking and threading its way through the grass, and gathering most of its food there. It may be commonly seen feeding

in newly-mown hay fields. It often perches on posts, poles, fence rails or tops of trees, usually in a conspicuous place. It sings from such vantage points, and also from the ground or in flight.

The call notes of the Meadowlark comprise a long harsh chatter, a single short but similar note, and a single longer note that is slurred downward with a harsh, somewhat nasal quality. The song is a loud, clear whistle, consisting of from two to six notes, most commonly four or five. In the majority of songs, two or more notes are slurred together, most of these slurs being downward in pitch. While the song is comparatively simple, it is subject to great variation. Anyone who attempts to fit the words "spring o' the year" to every Meadowlark song he hears will quickly note this. To some songs the words fit nicely; to many others they do not fit at all. This variation is indulged in by each individual bird, the bird singing one song for a time, then changing to something different.

The nest of the Meadowlark is placed on the ground, and well hidden in the tall grass. It is frequently arched over the top and usually contains five or six eggs or young.

COWBIRD. *Molothrus ater ater* (Bodd.)

This bird is a little larger than the English Sparrow. The entire body of the male is glossy black, while the head is dark grayish brown. The female is plain grayish brown all over, slightly glossy above, and somewhat lighter beneath. Young birds are colored like the female, but the breast is lighter and somewhat spotted with darker brown.

The Cowbird is common in the Park and found in all the open country. It lives chiefly in the open meadows, feeding on the ground. It may also be seen among shade trees or in orchards, and about the edges of thickets, but does not occur in the dense forests. In late summer it is most frequently seen in flocks, feeding on the ground in pastures, often among cattle, deriving its name from this habit.

The voice of the Cowbird is harsh or squeaky, but entirely unmusical. A note heard mainly in spring probably serves as a song. It varies somewhat, but a common form may be written, "wee-cheea," the second note slurred downward and delivered in an explosive manner that suggests a sneeze.

The habits of the Cowbird in the nesting season are well-known. It is a parasite, building no nest, but depositing its eggs in the nests of other birds, preferably smaller species than itself. On August 2 near the mouth of Wolf Run I found a young Cowbird that was being fed by a Canada Warbler.

BOBOLINK. *Dolichonyx oryzivorus* (Linn.)

This bird is a little larger than the English Sparrow. The male is black, marked with patches of white on the wings and lower back, and a patch of yellowish buff on the back of the neck. The female is plain brown, with darker stripes. All birds, including young, assume a striped plumage in late summer, when the breast is distinctly yellowish.

The Bobolink belongs to the open meadows where it occurs rather locally in the Park. I found it in fields near the lower end of Quaker Run, west of Limestone, and along the river a few miles west of Salamanca, but it is by no means as common or widely distributed as the Meadowlark or the Vesper and Savannah Sparrows. These birds live in the tall grass, or perch on fence posts, wires or trees.

The male sings either from a perch or in flight. The song is a beautiful one, long, loud and greatly varied. The notes are short and quick, with hardly ever two together on the same pitch. The song begins with notes that are low in pitch and somewhat slow, and becomes higher and faster as it proceeds. Certain groups of three or four notes are often repeated once or twice. There are no pauses, the bird not once stopping for breath as other flight singers are likely to do. To me there are no parts of the song that sound like "bobolink" or even "spink spank spink." The flight song is as a rule longer than that sung from a perch.

The nest is well hidden in the tall grass, and since the sitting bird has a habit of running some distance through the grass before flying, when one approaches, it is difficult to find.

NIGHTHAWK. *Chordeiles virginianus virginianus* (Gmel.)

This bird is about the length of the Robin, but when flying seems much larger because of the long, pointed wings. It may be best identified by the conspicuous white spot in each wing, and the peculiar swift, swooping flight. The plumage is mainly gray, and the male is marked by a white throat, and white marks in the tail.

This species is fairly common in the Park and still commoner in Salamanca. It may be seen toward evening, flying about in the open in search of insects. In the middle of the day it is seldom seen unless one finds it by accident, on a rock or bit of stony ground in an open field.

The Nighthawk has a single loud note, "peent," which identifies it easily, once it is known. In early summer it often swoops downward through the air, producing a loud booming or roaring noise with the wings.

It constructs no nest, but lays its two mottled eggs on a bare rock or on bare stony ground of an open hillside or ridge. In cities it finds favorable nesting sites on the flat, pebbled roofs of tall buildings. This habit is probably the cause of its greater abundance in Salamanca than in the Park itself.

MARSH HAWK. *Circus hudsonius* (Linn.)

The Marsh Hawk may be easily distinguished from all other Hawks by the white patch on the lower back, which is present in all plumages. Males are a beautiful light gray above, and white below. Females and young are brown above and streaked heavily with brown beneath. The narrow wings, long tail and peculiar flight will separate this Hawk from other large Hawks, almost as readily as the white of its lower back.

Marsh hawks are not common in the Park, and occur only in open country, flying over meadows and marshes. A single bird was seen in the Tunungwant Valley on July 23 and again on July 27. Two birds were seen together along lower Quaker Run on August 5. All birds seen were in the female or juvenile plumage.

The notes of the Marsh Hawk are a loud scream, used chiefly in the mating season when the male birds indulge in a curious undulating courtship flight, and a loud "eh eh eh eh eh" given when the nest is threatened.

The nest is placed on the ground in the tall grass of a meadow, or sometimes in a marsh. Whether the bird nests in the Park or not is a question that would be more easily settled in early summer. There are in fact a number of areas such as it would ordinarily choose for nesting sites. Females and young birds wander considerable distances in late summer, hence their presence in a locality is no certain indication of their nesting there.

PRAIRIE HORNED LARK. *Otocoris alpestris praticola* Hensh.

This bird is slightly larger than the English Sparrow. Its back is light brown, faintly streaked with blackish. There are black markings about the eyes and on the cheeks, and a white line over the eye. The throat is white or slightly yellow, and the under parts white with light brown sides. There is a black patch on the breast. The tail is black except the two middle feathers which are brown. The outer feathers are edged with white. On either side of the head are tufts of elongated feathers or "horns" which the bird can raise at will.

The Horned Lark is rare in the Park. It probably occurs mainly in open grass areas on hillsides. The only individual seen, however, was in the middle of a dusty road just west of Limestone on July 25. A high grass hill stands near this point, where the bird may have lived and bred, but my search on this hill for others of this species was unsuccessful.

The song of this bird is sung occasionally from a perch, but most frequently on the wing. It is a weak, high-pitched twitter, not especially musical. A high-pitched call note is characteristic and when once learned, easily identifies the bird. Except in the nesting season the bird is likely to be seen in flocks.

The nest is placed on the ground in a grassy field, and is often in a hollow so that its rim is level with the ground.

GRASSHOPPER SPARROW. *Ammodramus savannarum australis* Mayn.

The Grasshopper Sparrow is smaller than the English Sparrow. It may be distinguished from the Vesper and Savannah Sparrows by the lack of spots or stripes on the breast, and from other plain-breasted Sparrows by the buff color of throat and head and yellow mark in the bend of the wing.

This bird is rare in the Park, occurring in open grass meadows. I have met with it in but three places within the Park area: south





Drawn by Edmund J. Sawyer

PLATE 26. BIRDS OF THE UPLAND THICKETS AND WOODS MARGIN

- | | |
|---|---|
| 1, Brown Thrasher. | 6, Field Sparrow. |
| 2, 3, Indigo Bunting (male and female). | 7, 8, Mourning Warbler (male and female). |
| 4, 5, Towhee (male and female). | 9, Chestnut-sided Warbler. |

of Salamanca, July 14; west of Limestone, July 23; and in the Cold Spring Valley, July 20. Only one bird was seen in each place. Outside the Park area I found two birds west of Salamanca along the river on July 3.

The song should be carefully distinguished from that of the Savannah Sparrow which it resembles. It sounds like "zip ze-ee-ee-ee" differing from the Savannah by the single "zip" and single long "zee." The song is not so loud but more grasshopper-like than the Savannah Sparrow's.

The nest of this bird is well hidden in the grass of a meadow. It is made of grasses and usually arched over the top.

BIRDS OF THE UPLAND THICKETS

Many birds live mainly in and about low bushes, particularly those that are thick and thorny (plate 26). Such birds are not likely to be found in the forest or among tall trees, nor do they favor open meadows. Almost all small birds are inhabitants of bushes to some extent, as these bushes are a protection from Hawks and other natural enemies.

In the Allegany Park, thicket areas are common and of several sorts. Areas of natural forest land that have been recently cut form thickets of young sprouts that are either oak and chestnut or maple and beech in type (figure 77). In other places, hillsides formerly cleared and either cultivated or used for pasture, were later abandoned (figure 78), and these areas have a thicket growth mainly of seedling trees rather than sprouts. Particularly where there have been pastures, other species than the forest trees have come in, such as the thorns (*Crataegus Crus-galli* and *C. coccinea*), apple (*Pyrus Malus*), choke cherry (*Prunus virginiana*), and silky dogwood (*Cornus Amomum*). There seems to be a greater abundance of hornbeam (*Carpinus caroliniana*) in seedling thickets, but except for this the tree species are about the same as in the two forest types. There seems to be no great difference in the bird life of the different sorts of thicket.

Along the stream border are areas that also might be classed as thicket, but with different species of both birds and plants. I have considered this type under the heading: "Birds of the Stream Thickets."

As thickets grow up to forest, an ecological succession of animals as well as plants results, the thicket birds disappearing and the forest species taking their place. One may find woodland areas of different ages in the Park that illustrate this. The final change seems to take place when the cover is ten to fifteen feet high, but owing to the denser growth, this occurs sooner in the maple and beech than in the oak and chestnut type. In the same manner, where grasslands slowly grow up to thickets, a succession takes place from birds of the open fields to birds of the dense thickets.

In addition to the species listed here as occurring in thickets the following, listed under other habitats, are often found there:

Mourning Dove, both Cuckoos, Goldfinch, Song Sparrow, Rose-breasted Grosbeak, Cedar Waxwing, Maryland Yellow-throat, Canada Warbler, Catbird and Veery.

INDIGO BUNTING; INDIGO-BIRD. *Passerina cyanea* (Linn.)

This little bird is smaller than the English Sparrow. Its entire body is brilliant blue, darker on the head. The wing and tail feathers have blackish or dusky edgings. The female is plain grayish brown, not striped beneath, with a faint bluish tinge to the wings not easily detected in the field. She is liable to be mistaken for a sparrow unless in the company of her mate.

The Indigo Bunting is one of the commonest birds in the Park. In fact it is more abundant in this region than in any other with which I am acquainted. I consider it second only to the Song Sparrow in numbers here. It is an inhabitant of thickets mainly, but is also found along the stream border among low bushes, its distribution and associations being quite similar to those of the Towhee.

The song of this bird is loud, high-pitched and not particularly musical in quality. It is quite variable in form, but usually decidedly rhythmic, the notes being grouped in ones, twos and threes, each group occupying the same amount of time. The pitch moves up and down irregularly, but all the notes of one group are pitched alike.

The nest of this bird is in a thick bush or tangle of vines, usually not more than three feet from the ground. The eggs are white or faintly tinged with blue.

TOWHEE; CHEWINK. *Pipilo erythrophthalmus erythrophthalmus* (Linn.)

This bird is nearly as long as the Robin, with a rather long tail and short wings. The male is mainly black above, with white marks in wing and tail, black breast, white under parts, and sides broadly brownish red. The female is a soft brown where the male is black, but otherwise similar, while young birds are striped in dull brown.

The Towhee is quite common in the Park, and found mainly in thickets that are either second growth where forests were cut over, or old pasture lands overgrown with bushes and young trees. It prefers thickets on the drier hillsides as a rule, but is sometimes found in valleys along streams. It is a bird of the ground and low bushes, getting much of its food by scratching among leaves and debris.

The call of this bird, "chewink," is a clear note with an upward slur, from which it derives its names. "Chewink" sounds to me more like the call than "towhee." The song consists most often of two notes, followed by a trill. Most commonly the first note is highest, the second lowest and the third medium in pitch, but the first notes are sometimes reversed. The words "drink your tea" have been put to it, and while this is a better fit than

most English words put to bird song, "tink you terererere" would be better. Songs with but one low note followed by a trill, "ting tr r r r," are common; and other variations, sometimes rather puzzling, are to be heard.

The nest is placed on the ground under bushes or a few feet up in a thick bush. A nest found July 6 on Quaker Run, was in a silky dogwood, and another with four eggs, found July 13 near Red House Creek, was also in a bush. It may be that in this region nests are commonly placed in bushes, but in most localities ground nests are more common.

FIELD SPARROW. *Spizella pusilla pusilla* (Wils.)

The Field Sparrow is smaller than the English Sparrow. It may be known by the unstriped, grayish white breast, pale reddish brown upper parts with the head no redder than the back, and by its pinkish bill and feet. Young birds are striped on the breast.

The Field Sparrow is one of the common thicket birds of the Park, being found in young second growth where forests have been recently cut, or in thickets that have sprung up on old pasture hillsides. It is entirely characteristic of such places and not likely to be found elsewhere.

The song of this bird is one of the sweetest and purest in quality, though simple in form. It consists of short, quick whistles that grow rapidly faster, finally ending in a trill. Changes in the pitch are usually gradual, the song slowly grading up or down to its termination. The introductory notes are often slurred, more commonly downward, but frequently upward.

The nest is placed in a thick bush two to four feet from the ground. Rarely it is on the ground itself, but when this is the case, under a bush. It is much like the Chipping Sparrow's nest, lined with hair or sometimes grasses, but instead of blue, the eggs are white and spotted with reddish brown.

CHESTNUT-SIDED WARBLER. *Dendroica pensylvanica* (Linn.)

The Chestnut-sided Warbler, smaller than the English Sparrow, is beautifully and strikingly marked. The top of the head is bright yellow, and the remainder of the upper parts olive-brown, striped with black, with broad yellowish white bars in the wings and white patches on the outer tail feathers. The under parts are white, the conspicuous white cheek patch marked off by black lines and each side marked with a stripe of brightest chestnut. The male and female are similar but the male much more distinctly marked.

This little bird is quite common in thickets in the Park. Wherever original forest has been cut over and has grown up to sprouts or seedlings five to ten feet in height, this warbler is common. It is also found in the more open oak and chestnut forests, where there is an undergrowth of such shrubs as azalea, blueberry, silky dogwood or New Jersey tea. It is entirely absent in the more dense maple and beech woods.

The song of this warbler is loud and clear, of fair musical qual-

ity, and when sung in its most typical form thoroughly distinctive. It consists of six to ten notes, with the next to the last note highest in pitch, longest in time, and loudest in accent. The last note is dropped suddenly in pitch and not accented. It may be written "cherwee cherwee cherwee cherweechy." Other variations of the song are less commonly heard, less definite in form, and consequently less easily recognized.

The nest of this bird is placed in a low bush such as blueberry, azalea or *Ceanothus*, very near the ground. It is the usual warbler nest, a cup-shaped structure of bark, fibres, leaves and grasses.

BROWN THRASHER. *Toxostoma rufum* (Linn.)

The Brown Thrasher, erroneously called also Brown Thrush, is a little longer than the Robin. It is a long-tailed but rather short-winged bird, with a long, sharp, somewhat curved bill. The upper parts are bright reddish brown, with two white bars on the wing. The under parts are white, streaked on the breast and sides, but not the throat, with brown. While colored like a thrush this bird is distinctly different in shape, as well as in habits and song.

This bird is fairly common in the Park, living in thickets of low dense briery bushes. It is easily found in early summer when it is singing at the best, but the song ceases earlier than most species, after which the bird is seldom seen. It does not often go far above the ground, but when singing chooses as high a perch as there is in its vicinity.

The song is loud, clear, long-continued and greatly varied. It consists of short, quick phrases, each repeated rapidly two or three times, then a short pause before the next phrase is taken up. The time is now accelerated, now retarded; the pitch may vary as much as two octaves from highest to lowest notes, and even the quality changes, most of the notes being musical, but occasional harsh or squeaky sounds are uttered. The bird is a master musician when he chooses to be, but has nothing like the quiet song so greatly loved and admired in the thrushes.

The nest is placed in a low, thick bush or on the ground under such a bush. It is seldom more than three feet from the ground, and is built of sticks and twigs and lined with roots. The eggs are thickly spotted with fine brown spots on a bluish ground.

MOURNING WARBLER. *Oporornis philadelphia* (Wils.)

This beautiful little bird is plain olive-green above. The throat and upper breast are gray, shading in the male to black across the center of the breast. The lower breast and under parts are bright yellow, the line between black and yellow being abrupt and distinct. The female may be known by her gray throat, without black.

This warbler is well distributed in various parts of the Park, but not particularly common anywhere. I found it most frequently in open spots on the border of forests of both maple-beech and oak-chestnut types, where there were dense thickets of raspberry and blackberry bushes. It is evidently an inhabitant of thickets rather than of true forests.

This is a bird I was not well acquainted with before my experience in the Park, and I am not sure the description of the few songs I heard will be typical for the species as a whole. The voice is loud and clear, like that of the Yellow-throat, but the form of the song is quite different. I wrote it "tolee tolee tolee tootletoo" the first part of three or four pairs of notes, higher in pitch, and the last a three-note phrase, and lower. One bird that I heard appended a five-note phrase, "tootletooleeloo," to its song.

The nest of this bird is placed on the ground. Young, out of the nest, were found several times about Quaker Run in July.

YELLOW-BREADED CHAT. *Icteria virens virens* (Linn.)

The Chat, although classed as a warbler, unlike all the others of that family, is larger than the English Sparrow. Its upper parts are plain olive, the throat and breast rich yellow, sometimes almost orange, and under parts white. A white line over the eye is the only specially distinguishing mark. The bill is rather shorter and heavier than those of other warblers.

The Chat is a rare bird in this region and I have not actually found it within the Park area. A single bird, in song, was observed in a thicket along the road below Salamanca, not far from the mouth of Red House Creek. An empty nest in a bush that looked like that of a Chat was also found, but there was no way to prove its ownership.

To the field student there is nothing about the Chat, unless perhaps its olive and yellow coloring, that suggests a warbler. Its habits and song are totally different from those of the rest of the family. It is a shy and secretive bird, keeping back in the dense thickets, and making no outcry, even when nest and young are threatened.

Were it not for the song this bird would be very difficult to locate. It is a most peculiar one, made up of various odd phrases sung at intervals, with long pauses between them. The phrases are sometimes whistles, sometimes clucking noises, or again squeaky or harsh and rasping. They may be single abrupt notes or a long series of notes. One common phrase comprises a series of low whistles, on the same pitch or running down toward the end, and becoming slower and slower in a perfect *ritardando*. A representation of the song as commonly heard might be as follows: "Whew — kak-kak-kak — whee — kekekekekek — — — hoo hoo hoo hoo hoo — — hoo — — — hoo — — — — hoo," etc.

The nest is well hidden in a thick bush or tangle of vines, and is seldom more than three feet above the ground. The sitting bird slips quietly away when approached, and keeps adroitly out of sight while the intruder is near.

CARDINAL. *Cardinalis cardinalis cardinalis* (Linn.)

Nearly as long as the Robin, with longer tail, the brilliant red body, wings and tail, crested head and black face of this bird make it unmistakable. Yet many an amateur sees a Tanager and calls

it a Cardinal. The female is mainly gray, with tinges of red on crest and wings.

It is a curious fact that rarities among bright colored birds are likely to be found frequently by amateurs far out of their range, whereas duller colored birds, extremely common in their vicinity, remain unknown. The Cardinal is rare in the Park, whereas the other red bird, the Scarlet Tanager, is decidedly common. The finding of this southern bird along a roadside where I had just been listening to Hermit Thrushes and Juncos, was a decided surprise to me. A pair of birds was found on July 23 along the road up Limestone Brook, some four miles west of Limestone, and the male again July 26. I am informed by Mr. T. L. Bourne of Hamburg that this species occurs regularly but rarely in Western New York, and seems to be increasing. It is mainly an inhabitant of thickets and low bushes.

The song of the Cardinal is a series of clear, loudly reiterated whistles, sometimes slurred up the scale, sometimes down. The song often grows louder toward the end. It is exceedingly variable: the bird found in the Park was singing no less than six variations. The four commonest of these songs I wrote as follows: 1. "Twit twit cheeah twit twit twit twit." 2. "Toowet toowet tootootootootootootoo." 3. "Toolet toolet toolit toolit toolit toolit." 4. "Teeo teeo teeo teeo teeo teeo teeo teeo."

The nest is placed in a low, thick bush, usually not far from the ground. The eggs are finely speckled with brown.

BIRDS OF THE FOREST

Forests cover the larger part of the Allegany Park. A characteristic view of these is shown in figure 79. To most visitors these forests will be of greater interest than the other areas. The birds that occur in forests are less well known than those of orchards and fields, yet they are often equally common.

Two distinct forest types occur in the Park, the oak and chestnut forest, and the maple and beech forest (figure 80). The occurrence of either type seems to depend more upon soil and exposure than upon altitude or climatic differences. Oak and chestnut forest covers the smaller area of the two and occurs more commonly on the west side of the Park near the river, on gentle south and west slopes, or broad, flat ridge tops. The maple and beech forest covers the larger area, being the only type found about the heads of streams. It occurs on steep or gentle slopes of north or south exposure or along the tops of ridges, seeming to follow no fixed rule except near the river where it prefers the north and east slopes, leaving the south and west areas to oak and chestnut. While many birds occur only in the maple-beech forest, there seem to be no birds that are characteristic of oak and chestnut alone, although there are many plants that are strictly so.

We may further divide the birds of the forest roughly into those that inhabit the forest floor, those that inhabit the undergrowth,





Drawn by Edmund J. Sawyer

PLATE 27. BIRDS OF THE FOREST FLOOR AND UNDERGROWTH

1, Hermit Thrush.

2, 3, Hooded Warbler
(male and female).

4, 5, Junco (male and female).

6, Chickadee.

7, 8, Black-throated Blue Warbler
(male and female).

9, Winter Wren.

10, Oven-bird.

11, Wood Thrush.

those that live on the tree trunks and among the larger limbs, and those that live in the tree-tops. No hard and fast rule may be made for any species, however, for those birds feeding and nesting mainly on the ground are often in the undergrowth or even the tree-tops, while those of the tree-tops may descend to the undergrowth or the ground frequently. (See plate 27).

In the forests of the Park are to be found some of the most interesting, most beautiful and most musical of our birds. Such species as the Ruffed Grouse, the Woodcock, and the great Pileated Woodpecker are of interest to everyone. Among the strikingly beautiful birds not only is the brilliant Scarlet Tanager of common occurrence, but also such little woodland gems as the Black-throated Blue, Black-throated Green, Magnolia and Blackburnian Warblers are to be met with almost daily.

The Tanager, various warblers, and the persistent Red-eyed Vireo, whose song is the commonest bird note of the forest, are not remarkable singers. But the soft sweet notes of the Blue-headed Vireo, and the tinkling trills of the Winter Wren will long be remembered by the lover of bird music. Few areas can boast of the songs of four thrushes, the best of all American songsters; yet in the forests of the Park are three, while the Veery along the stream border near the edge of the forest, makes the fourth. The occasional Olive-backed Thrush is well worth listening to, although its music is least enchanting of the four. In special localities Wood Thrushes, with their wonderful flute notes, answer each other through the forests. Most abundant and perhaps best of all are the Hermit Thrushes, whose notes, as clear and sweet as the tones of a bell, are frequent sounds in the depths of the forest, especially in the morning and evening. He who wisely chooses early summer to visit the Park can hardly fail to hear this bird at its best.

Birds of the Forest Floor. The forest floor in the Allegany Park is not only all that might be desired from the forester's standpoint, with a deep, moist humus that results in wonderful reproduction of the trees, but to the lover of nature it is of great beauty and interest also (plate 27 and figure 81). Here are many picturesque, moss-covered logs, beautiful beds of ferns, and tangled masses of trailing vines and woodland plants with leaves of many shapes and shades of green (figure 82). The lover of wild flowers, if he knows the meaning of these many summer leaves, will long to see the plants in full bloom in May and June. In July only the *Dalibarda*, whose white flowers suggest the spring freshness of an *Anemone*, blooms to give a hint of what must have been there a month or two before.

The plants of the forest floor differ somewhat in the two types of forest, some species being found in both types while others are confined to only one. Owing to the fact that in some species the entire plant dies down before midsummer, and in others the lack of flowers at that season makes identification uncertain, it is probable that many species are omitted from the following list.

The plants found in both types of forest, in order of abundance

are wintergreen (*Gaultheria procumbens*), partridge berry (*Mitchella repens*), hay-scented fern (*Dicksonia punctilobula*), lady fern (*Asplenium Filix-femina*), white clintonia (*Clintonia umbellulata*), dalibarda (*Dalibarda repens*), crested shield fern (*Aspidium cristatum*), wild lily of the valley (*Maianthemum canadense*), jack-in-the-pulpit (*Arisaema triphyllum*), christmas fern (*Aspidium acrostichoides*), blue-stemmed goldenrod (*Solidago caesia*), round-leaved yellow violet (*Viola rotundifolia*), trillium—three species of which, the red (*Trillium erectum*), white (*T. grandiflorum*), and painted (*T. undulatum*), are reported blooming in spring but are not easily distinguished in summer by the leaves,—mandrake (*Podophyllum peltatum*), downy yellow violet (*Viola pubescens*), maidenhair fern (*Adiantum pedatum*), club mosses (*Lycopodium complanatum*, *L. obscurum*, *L. clavatum* and *L. lucidulum*), polypody (*Polypodium vulgare*), evergreen wood fern (*Aspidium marginale*), white wood aster (*Aster divaricatus*), rattlesnake fern (*Botrychium virginianum*), star flower (*Trientalis americana*), indian cucumber-root (*Medeola virginiana*), bellwort (*Uvularia perfoliata*), false solomon's seal (*Smilacina racemosa*), wild ginger (*Asarum canadense*) and indian pipe (*Monotropa uniflora*).

Plants occurring only in maple and beech forest are the barren strawberry (*Waldsteinia fragarioides*), goldthread (*Coptis trifolia*), Canada violet (*Viola canadensis*), wood sorrel (*Oxalis acetosella*), wood reed (*Cinna arundinacea*), mountain aster (*Aster acuminatus*), long beech fern (*Phegopteris polypodioides*), silvery spleenwort (*Asplenium acrostichoides*) and showy orchis (*Orchis spectabilis*).

Plants occurring only in chestnut and oak forest seem more numerous. These are brake (*Pteris aquilina*), oat grass (*Danthonia spicata*), dogbane (*Apocynum androsaemifolium*), tick trefoil (*Desmodium*) of several species, fireweed (*Epilobium angustifolium*), false foxgloves (*Gerardia flava* and *G. laevigata*), fringed loosestrife (*Steironema ciliatum*), wood betony (*Pedicularis canadensis*), arbutus (*Epigaea repens*), pyrola (*Pyrola elliptica*), four-leaved loosestrife (*Lysimachia quadrifolia*), pearly everlasting (*Anaphalis margaritacea*), bottlebrush grass (*Hystrix patula*), pipsissewa (*Chimaphila umbellata*), pink and yellow lady slippers (*Cypripedium acule* and *C. pubescens*) and red wood lily (*Lilium philadelphicum*).

In late summer, among the plants of the forest floor are numerous fungi, growing either from old logs and stumps or on the ground itself. These fungi may have some indirect relation to bird life in that some of the numerous insects that feed upon them may be food for birds. Their varied forms and colorings make them an attractive part of the forest life. Many are good edible species, and will furnish the camper who dares to gain a knowledge of them and use it, with many good meals. On old logs and stumps, such genera as *Fomes*, *Polyporus*, *Fistulina*, *Daedalea*, *Pleurotus* and *Pluteus* are represented. On the ground grow not only the poison-

ous *Amanita*, but many edible species of *Collybia*, *Clitocybe*, *Russula*, *Lactarius*, *Boletus*, and woodland forms of *Agaricus*.

OVEN-BIRD. *Seiurus aurocapillus* (Linn.)

This bird, which is only slightly smaller than the English Sparrow, is of a uniform olive-brown color on the back and wings. The brown of the head is dull orange with a blackish stripe on either side. The under parts are whitish, spotted or streaked on the breast and sides with black.

The Oven-bird is abundant in both types of forest in the Park. It lives on the ground or among the undergrowth and lower branches, preferring forest that is open and without dense underbrush. When on the ground it walks in a deliberate manner, not like the walking sparrows, but more like a game bird, or a hen in the barnyard. This habit alone will mark it at once and should help to identify it as readily as its coloring, which is not as brilliant as most of the other warblers.

Its singing is the well-known "teacher." song. Preferring not to put English words to bird songs, but to write them as they really sound, I should translate it as "kadee kadee kadee kadee kadee," the second syllable higher pitched than the first, longer in time, and accented. The whole song usually becomes louder as the bird proceeds. A very different song, to be heard more commonly in early summer than in spring, is usually given in flight, and is less easily described. It is a varied, warbled strain, running up and down in pitch and hardly ever twice alike. In the middle of it the bird usually interpolates two or three of the "kadee" notes, then pauses an instant as though out of breath, before finishing the song.

The nest is placed on the ground in the forest, and is arched over the top, its shape resembling an old-fashioned oven, giving the bird its name. It is difficult to find unless by accident, when one almost steps on it; and the little mother, like many other ground nesters, runs away with a wing dragging as though badly hurt.

SLATE-COLORED JUNCO. *Junco hyemalis hyemalis* (Linn.)

This little bird, a trifle smaller than the English Sparrow, is easily identified by its plain gray back and breast, and the white outer tail feathers and white under parts. The female is browner than the male, and juveniles are streaked on the breast; but all show the characteristic white in the tail.

This is a common bird in the maple and beech forest of the Park, being found most commonly about the edge of the forest or along roadsides. It lives and gets its food on the ground or amid the undergrowth and lower branches of the trees.

The song of this bird is a simple trill, usually all on one pitch. It is quite similar to that of the Chipping Sparrow but rather more musical, and never, so far as my experience goes, with notes so fast that they cannot be counted. The bird also has characteristic call notes, the commonest sounding like "tetete" and the other a short "tsip" used when the young or nest are threatened.

The nest of the Junco is placed on the ground, usually in the side of a bank, and in a hollow so that the rim is level with the ground. It is often most attractively situated among mosses, ferns and woodland plants. The nest shown in the illustration (figure 83) was found in Quaker Run Valley, in a pasture close to the edge of the forest. Another nest was discovered on Limestone Brook, and a third was shown me above Frecks at the camp of the Buffalo Society of Natural Sciences.

RUFFED GROUSE. *Bonasa umbellus* (Linn.)

This bird is not easily mistaken for any other, it being the only one of the true game bird group occurring naturally in the Park. It is mainly mottled brown above and lighter beneath, and somewhat smaller than the Crow. The roaring noise of its wings when it is flushed in the woods is also sufficient identification.

This bird is quite common in nearly all forested areas in the Park. It is perhaps less frequently found in the mature timber but such areas are small and scarce. It lives on the ground in the forest, occasionally perching in the lower limbs of trees.

Aside from the noise made by the wings in flight this bird has several call notes. A "tuck-tuck-tuck-tuck" as slow and measured as the ticking of a clock, is the call of a mother bird to her brood. When the young are in danger the mother produces a whining noise as though in pain, and runs away dragging one wing. In spring the male produces the loud drumming with his wings, a sound so low in pitch one seems to feel rather than hear the vibrations. This drumming is accelerated in time, beginning with slow beats, and ending in a long roll.

The nest is placed on the ground in the forest, usually at the base of a tree or stump. Broods of young accompanied by the mother bird, were observed commonly in the Park in early July.

Since the sub-species of this bird in the Park is questionable, I have left the name in binomial form.

WOODCOCK. *Philohela minor* (Gmel.)

This bird, a little longer than the Robin, and with a decidedly heavier body, may be known by its long bill and mottled brown and black back. It could hardly be mistaken for any other bird, the smaller size, longer bill and peculiar wavering flight separating it immediately from the Ruffed Grouse.

The Woodcock is well distributed in the forested areas of the Park. It prefers woodland where the ground is moist and soft, but this applies to many places other than the stream border areas, and it seems to be commoner in the forest than along streams.

This bird has a number of notes, some vocal and some made with the wings. In early spring it indulges in a remarkable spiral flight in the evening twilight, the wings making a curious winnowing sound. Some vocal performances accompany this, particularly a call "peent" which prefaces the flight and sounds much like the call of the Nighthawk.



Fig. 79. The maple and beech forest, showing characteristic undergrowth and old logs, an environment that attracts certain birds. Yellow birches in foreground.



Fig. 80. Heavy mature forest in the Big Basin, near head of Stoddard Creek. Home of the Hermit and Olive-backed Thrushes, and the Winter Wren.



Fig. 81. A view of the forest floor, the favorite haunt of Oven-bird, Ruffed Grouse, Whip-poor-will, Junco, Winter Wren, Woodcock and others.

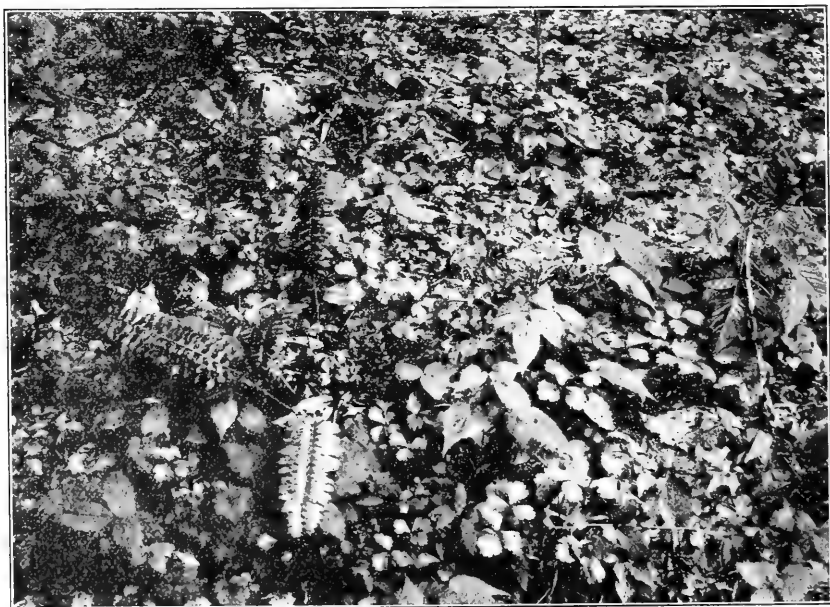


Fig. 82. The forest floor, with dense carpet of shade-loving herbs, ferns and vines. Here, one would expect to find the shy Hermit Thrush and elusive Winter Wren.

The nest is a hollow on the ground in the forest, usually containing four eggs. The female sits very closely on her eggs. The finding of nests and downy young in the Park is reported by several persons.

WHIP-POOR-WILL. *Antrostomus vociferus vociferus* (Wils.)

This bird is likely to be known to the Park visitor mainly if not entirely by its voice. Rarely one sees a bird in the forest, by almost stepping on it, whereupon it flies to some nearby limb, on which it perches lengthwise. The mottled plumage, long wings and noiseless flight easily identify it. Only the Nighthawk is at all like it, and that bird is not likely to be found in the forest.

How common the Whip-poor-will is in the Park it is hard to say. I did not happen to see a single individual, and did not explore much of the Park area at night when it is most often heard. In July one or more birds were always to be heard on the hillsides near Tunesassa (Quaker Bridge).

The call of this bird has given it its common name. It is repeated over and over with perfect rhythm. There is considerable variation but all the birds I heard in the Park sing with the first note medium in pitch, the second low, and the last high and not slurred.

The Whip-poor-will makes no nest, but lays its two mottled eggs on the ground in the forest, where they are likely to be found only by accident.

WINTER WREN. *Nannus hiemalis hiemalis* (Vieill.)

The Winter Wren is even smaller than the House Wren, with a shorter tail and rounder body. The color of the back is a richer brown, barred with dark brown on wings and tail. The under parts are also brown, but somewhat lighter.

This little bird is rather rare in the Park. I met with but two, one near English Run, perhaps a female, for it did not sing; and the other in the Big Basin, a male that sang its delightful, rapid, bubbling song over and over again. The bird frequents dense, dark forests where it lives among the old logs and roots of wind-falls, seldom going far above ground.

The song is varied and longer than most bird songs, and delivered in a high, sweet voice that does not seem loud, but carries a considerable distance. It is quite varied in both pitch and time, but usually contains a long trilled note in the middle or near the end, that suggests a note of the canary. While hardly to be ranked with the thrushes this bird is one of the finest singers in the forest, far ahead of the warblers or the vireos. The song belongs to the deep cool shade of the forest, and suggests to the bird lover who associates sounds with places, old moss-covered logs and a forest floor covered with fern, partridge berry, goldthread and wood sorrel.

The nest of this wren is hidden in a crevice of an old stump or the roots of an overturned tree. It is made of twigs and moss and lined with feathers.

Birds of the Forest Undergrowth. The undergrowth of the forest is attractive to many birds that neither live much on the ground nor range up to the tops of the trees. This undergrowth consists partly of young trees of the same species as those forming the main forest, and partly of smaller trees and shrubs (figure 84).

The species of small trees and shrubs found in both types of forest are witch hazel (*Hamamelis virginiana*), flowering dogwood (*Cornus florida*), hornbeam (*Carpinus caroliniana*), and the raspberries and blackberries (*Rubus*). In the maple and beech forest, hobblebush (*Viburnum alnifolium*), maple-leaved viburnum (*V. acerifolium*), shad bush (*Amelanchier canadensis*), striped maple (*Acer pennsylvanicum*) and moosewood (*A. spicatum*) are characteristic. In the oak and chestnut forest, sassafras (*Sassafras variifolium*), which seldom reaches tree size here, bush honeysuckle (*Diervilla lonicera*), silky dogwood (*Cornus Amomum*), beaked hazel (*Corylus rostrata*), wild currant (*Ribes*), poison ivy (*Rhus Toxicodendron*), sweet fern (*Comptonia peregrina*), thimbleberry (*Rubus odoratus*) and mountain laurel (*Kalmia latifolia*) are found.

BLACK-THROATED BLUE WARBLER. *Dendroica caerulescens caerulescens* (Gmel.)

Nearly all of the Warblers are strikingly colored birds, and while the male Black-throated Blue is not as brilliant as some other members of the family, none presents a neater appearance, or a daintier contrast of pleasing colors. He is grayish blue above, somewhat darker than the Parula or Cerulean, and enlivened by a spot of white on the edge of the wing and other spots on the outer tail feathers. The throat and sides of the breast are black and the under parts pure white. The female is less like her mate than in the case of most other warblers. She is plain dull greenish above and yellowish white beneath, with only a small white spot on the edge of the wing to suggest her relationship.

This is one of the common forest birds of the Park, well distributed through the maple and beech forest and occasionally found also in the oak and chestnut. It lives in the low bushes and small trees forming the undergrowth of the forest and for that reason is more likely to be easily seen than any other forest warbler; but it is really a little less common as revealed by its song, than the Black-throated Green and Magnolia.

The song of the Black-throated Blue is short, slow in time, and delivered in a peculiarly husky voice. There are usually but four notes, the first three even in pitch and the last drawling slowly upward. It may be written "shree-shree-shree-shree-ee-ee."

The nest is a cup-like structure, built of bark, leaves and fibres, and placed in a bush or small tree only a few feet from the ground. In most places it is said to prefer such evergreen species as mountain laurel and rhododendron, but since both these shrubs are decidedly scarce and local in the Park this cannot be the case here.

HERMIT THRUSH. *Hylocichla guttata pallasi* (Cab.)

The Hermit Thrush is only a little larger than the English Sparrow. Its upper parts are uniform olive-brown, except the tail, which is abruptly reddish brown, the best field mark by which to identify it. The under parts are white, spotted on the breast with dark brown spots, smaller than those on the Wood Thrush, about the same as those of the Olive-back and darker than those of the Veery. The young are similar to the adults, but streaked with buff or whitish on the back.

This is the commonest and most widely distributed thrush in the Park, found nearly everywhere in the maple and beech forest, but noticeably not found in oak and chestnut nor where the Wood Thrush occurs, though there may be cases where there are Wood Thrushes on one side of a stream valley and Hermit Thrushes on the opposite slope. It lives in the lower branches and underbrush of the forest, and is much more frequently heard than seen.

The Hermit Thrush's song is one of the most beautiful and inspiring of American bird songs. The notes are as clear, sweet and resonant as those of the purest-toned bell. The song consists of phrases of six to ten notes each. Each phrase usually begins with a long low note, and is followed by higher and faster notes, grouped in twos and threes, each group descending in pitch, but usually higher than the last group. Each complete phrase is pitched higher or lower than the one preceding it. An occasional phrase is pitched an octave or more higher than the others, when the notes are less resonant and musical than other phrases of the song. Unlike most bird songs, the low notes are louder and carry farther than the high ones, so that the last notes are often inaudible in distant birds. This Thrush may be heard frequently in the Park in early summer, but ceases to sing in early August, so that visitors who listen for it in the latter part of that month are likely to be disappointed.

The nest of the Hermit Thrush is usually placed on the ground and made of mosses, leaves and roots. The eggs are greenish blue and unspotted.

CHICKADEE. *Penthestes atricapillus atricapillus* (Linn.)

The Chickadee is smaller than the English Sparrow. The top of its head, and a spot on the chin and throat are black, while the cheek space between these marks is pure white. The back, wings and tail are gray, the wings with white-edged feathers. The under parts are dull white, with the sides, in fresh plumage, buff.

The Chickadee is common throughout the forests of the Park and found in both kinds of forest, frequenting the lower limbs of the trees and undergrowth. It is an active little bird, continually flitting about among the branches, usually in small companies in late summer and through the winter. Chickadees are quite tame and confiding, often approaching an observer closely, and may sometimes be induced to feed from one's hand.

The common call of the Chickadee is the well-known "chickadee-dee-dee." It has another call of more whistled quality that

sounds like "tickleweetletoo," and several faint lisping notes. The song is two long sweet whistles, the second about a tone lower than the first in pitch, "phee-wee." This song, if it is truly such, is likely to be heard in any month of the year, though perhaps more commonly in spring than at other times. If one can learn to imitate it closely, the imitation will often bring an answer, and sometimes call the birds close to the observer, even in the winter.

The nest is placed in a hole, frequently one that the birds have excavated themselves in a punky birch stump. In the absence of white birch in the Park, these birds use yellow birch equally well. A number of unoccupied nesting holes were found in stubs of this species. The inside of the hole is lined with soft materials, such as rabbit fur. There are seven or eight young and sometimes even more, a family that keeps the parents busy gathering small insects.

WOOD THRUSH. *Hylocichla mustelina* (Gmel.)

The Wood Thrush is a little smaller than the Robin and a bird of very much the same shape and build. Its upper parts are uniform brown, shading to bright reddish brown on the head. The under parts are white, heavily spotted with large, round, dark brown spots.

This bird is rather locally distributed in the Park, common in some localities and unknown in others, but found in both types of forest. On the whole it is much less common than the Hermit Thrush, and the two species do not appear to occur together. The Big Basin is a Wood Thrush locality. No less than three birds were singing there at once, July 19, and young were noted there on August 1.

The song of this bird is one of the most beautiful to be heard in the Park. Whether it is superior to that of the Hermit Thrush is really a matter of personal opinion; but the true lover of bird music will pause to listen to either whenever the opportunity comes, and never cease to enjoy the sweet notes. The Wood Thrush song may be known by the clear, flute-like phrases of three or four notes each, with pauses between them, each phrase different from the last, the bird singing from three to five different phrases, before it repeats. The phrases are often prefaced or terminated with other notes of less loud or sweet quality, but these notes are only audible when one is near the singer.

The nest of the Wood Thrush is placed in a bush or small tree, usually ten feet or less from the ground. The nest is made of mud like that of a Robin, but is somewhat smaller. The exterior is covered with leaves and the interior lined with roots. The eggs also resemble those of the Robin, being greenish blue, without marks, and only slightly smaller and darker in color.

HOODED WARBLER. *Wilsonia citrina* (Bodd.)

This beautiful warbler is olive-green above and yellow beneath. A patch of black covers the entire throat, upper breast and sides and top of the head, leaving a bright yellow spot about the forehead

and eyes. The outer tail feathers are marked with white. The female is plain olive and yellow with slight traces of the black hood across her breast and on the top of the head. The young are plain olive and yellow with no distinguishing marks in first plumage, and unless the parents are near, they are difficult to distinguish from other olive and yellow warblers.

The Hooded Warbler is distributed in small numbers in many places in the Park, living in the undergrowth and dense bushes in the maple and beech forest. Although it may occur in oak and chestnut woods in the Park I have not found it there. It is not very common anywhere, but where observed at all several males are likely to be in song in that general locality.

The song of the Hooded Warbler is loud and emphatic. Like that of the Chestnut-sided Warbler, the next to the last note is higher in pitch and accented, but the quality and the time are different. The song may be written "Terwee terwee terwee *tee* too." In the Chestnut-side's song the accented note is longer in time than the last, but in the Hooded Warbler's the durations of the two notes are equal, the accent being due to greater intensity. There is some variation among individuals, but the accent of the next to the last note is a general mark of identification for all songs of this species.

The nest of the Hooded Warbler is placed in a bush a few feet from the ground. In regions where laurel grows it is practically always in such a shrub. No nests have been found in the Park, but as the laurel is rare, some other nesting site must be used.

OLIVE-BACKED THRUSH. *Hylocichla ustulata swainsoni* (Tschudi)

The Olive-backed Thrush is between Sparrow and Robin in size and may be distinguished from the other Thrushes of the Park by the uniform olive-brown coloring of the upper parts without reddish or tawny-brown anywhere. The cheeks of the bird are distinctly buffy, and the under parts white, with the usual Thrush spotting on the breast, heavier than the Veery's spots, lighter and smaller than those of the Wood Thrush, and almost the same as those of the Hermit.

The Oliver-back is the rarest of the four Park thrushes. I met with but three birds, one in the English Run valley, and the other two in the Big Basin. Like the other thrushes it lives in the lower trees and undergrowth of the forest.

The song of the Olive-back is sweet and pleasing, with something of the same beautiful qualities that make the thrushes as a group our very best singers; but hardly any observer will consider it equal to any one of the other three thrushes. Its song is less variable than that of the others. It consists of seven to nine notes, the first low in pitch, the remaining notes in pairs, each pair higher than the last one, but the second note of each pair lower than the first. The pairs of notes descend in pitch, but the whole song is ascending. Those who think this song confusingly like the Veery's should note this point, for the Veery's song invariably descends in

pitch. One might write the Olive-back song "oolalolaylallayleeyi," the broader vowel sounds denoting lower pitch. The notes of the Olive-back song are all nearly equal in time, and connected with the other notes without a pause. These points will always distinguish it from the Hermit, whose song is more variable than that of the Olive-back.

The nest of the Olive-backed Thrush is placed in a low bush or small tree, from three to fifteen feet from the ground. It is made of sticks, bark, grasses and roots. The eggs are greenish blue like those of other thrushes; but unlike them are spotted with reddish brown.

Birds of the Forest Trees. The sizable trees constitute the bulk of the forest and are the habitation of many birds. Some species are characteristically birds of the trunks and larger limbs, while others live among the branches and foliage.

The trees growing in the maple-beech forest are sugar maple (*Acer saccharum*), beech (*Fagus grandifolia*), hemlock (*Tsuga canadensis*), black birch (*Betula lenta*), yellow birch (*B. lutea*), white ash (*Fraxinus americana*), pin cherry (*Prunus pennsylvanica*), basswood (*Tilia americana*), butternut (*Juglans cinerea*), black cherry (*Prunus serotina*), red oak (*Quercus rubra*) and shag-bark (*Hicoria ovata*). Those constituting the oak-chestnut forest are chestnut (*Castanea dentata*) — which in this region is still only slightly attacked by the deadly blight, white oak (*Quercus alba*), red oak (*Quercus rubra*), pignut (*Hicoria glabra*), butternut (*Juglans cinerea*), common and large-toothed aspens (*Populus tremuloides* and *P. grandidentata*), shag-bark (*Hicoria ovata*), basswood (*Tilia americana*), white pine (*Pinus Strobus*), cucumber tree (*Magnolia acuminata*), bitternut (*Hicoria minima*), and mockernut (*H. alba*), chestnut oak (*Quercus prinus*), tulip tree (*Liriodendron tulipifera*) and black oak (*Quercus velutina*).

The only conifers of the forest are the hemlock and white pine. Conifers are especially attractive to some birds. In the maple-beech forest one will find the Black-throated Green, Magnolia and Blackburnian Warblers more frequently in or near hemlock trees (figure 85). White pine is not abundant in the Park, but in a few places it grows in small groups, making a forest type by itself, though of very small area. Crows and Blue Jays seem to like these clumps of pine. One or two Crows' nests are likely to be found in such clumps. The only Pine Warbler noted in the Park was in such a pine grove. This bird is probably not to be found during the nesting season except where pine occurs.

Species often found in the forest, but not listed under this heading are Mourning Dove, Screech Owl, the Cuckoos, Downy Woodpecker, Flicker, Chimney Swift (flying above), Ruby-throated Hummingbird, Least Flycatcher, Rose-breasted Grosbeak, Chestnut-sided Warbler, Mourning Warbler, Redstart, Veery and Robin.

I. Birds of Trunks and Limbs. Under this heading come the birds that live mainly about trunks of trees, getting their food largely



PLATE 28. BIRDS OF THE BRANCHES AND FOREST CROWN

- 1, 2, Scarlet Tanager
(male and female).
3, Red-eyed Vireo.
4, 5, Magnolia Warbler
(male and female).
6, Wood Pewee.
7, White-breasted Nuthatch.

- 8, 9, Black-throated Green Warbler
(male and female).
10, Blackburnian Warbler.
11, 12, Parula Warbler
(male and female).
13, Blue-headed Vireo.

Drawn by Edmund J. Sawyer

from insects and their eggs in the bark or wood, or in crevices on the surface. These birds are of high economic value to the forest as destroyers of such insects, nearly all of which are injurious. Some of them, as the Black and White Warbler for example, live also among the branches and foliage and to some extent forage or nest on the ground.

HAIRY WOODPECKER. *Dryobates villosus villosus* (Linn.)

This bird is about the size of the Robin, and easily recognized by its black and white coloring. It differs from the Downy Woodpecker mainly in size, but also in the unbarred white outer tail feathers. From the Sapsucker it may be distinguished by the continuous white back, the red on the back of the head instead of forehead or throat in the male, and the lack of a large white patch on the edge of the wing.

This is the commonest woodpecker in the forested areas of the Park, occurring in both types of forest. In summer it is not likely to be seen except in forests. It prefers rather open high forests, however, and will not often be found in the younger second-growth.

The commonest note of this woodpecker is a loud sharp "keep," differing from the call of the Downy Woodpecker mainly in its loudness. A longer call is something like the rattle of the Kingfisher, but slurs first upward, and then downward in pitch, while the Kingfisher's call maintains an even pitch.

The nest is placed in a hole in a dead tree or branch in the forest. This woodpecker is probably the most valuable to the forests of any species found in the Park.

WHITE-BREASTED NUTHATCH. *Sitta carolinensis carolinensis* Lath.

The White-breasted Nuthatch is about the size of the English Sparrow. It is light bluish gray on the back and white beneath. The top of the head and back of the neck in the male are glossy black, but in the female, dark gray. The cheeks and sides of the head, up to a line over the eye, are white. The tail is black, spotted with white on the outer feathers and the under tail coverts are reddish brown.

This bird is fairly common in all the forest areas of the Park, but prefers the more open oak and chestnut to the more dense maple and beech. Occasionally it is found all summer in orchards and shade trees. It lives about the larger limbs and trunks of trees, climbing over the rough bark and clinging by means of its strong feet. It does not use its tail for a brace, as the woodpeckers do, so can climb equally well with head up or down, a habit that will easily distinguish it from a woodpecker.

The call note of the Nuthatch is a nasal note sounding like "yank." It has a song indulged for a short time in spring or early summer. This is a series of low notes, all on the same pitch, with a slightly nasal quality, but more nearly a low whistle and more musical than the call note. The sound of it is much like that of the long call of the Flicker when heard from a distance.

The nest of the Nuthatch is built in a hole in a tree, sometimes a deserted woodpecker's nest, but more often, in my experience, a natural crack or cavity. A family of Nuthatches, adults and several young, were found near Limestone, running over the bark of a large butternut tree along the roadside. An old woodpecker hole in a dead limb of this tree was probably their home.

BLACK AND WHITE WARBLER; BLACK AND WHITE CREEPER.
Mniotilta varia (Linn.)

The Black and White Warbler is smaller than the English Sparrow. Its entire upper parts are striped in black and white. The throat and sides of the male are also striped with black, but the female's throat is pure white and her sides either unstriped or only faintly so.

The Black and White Creeper is found in summer mainly in the forest. It is less common in the Park than most of the other warblers, but is well distributed and may be met with anywhere in forested areas. It lives about the larger limbs and trunks of trees, creeping on the rough bark in search of insects, and managing to go with head up or down, like a Nuthatch. It should not be mistaken for the much larger Downy Woodpecker, the center of whose back is white without stripes, and who never goes down a tree head first.

The song of this bird is weak and high-pitched. It sounds like "weesy weesy weesy" repeated eight or ten times, the second syllable of each "weesy" being higher in pitch than the first. More rarely the bird drops one or two of these notes to a lower pitch toward the end of the song. The form suggests the strain of the Oven-bird, and where both species are heard singing near each other in the forest, the Black and White Warbler sounds like a weak, high-pitched echo of the other.

The nest of the Black and White Warbler is placed on the ground at the base of a tree or stump, and the bird often approaches it by creeping down the trunk. Though the nest is on the ground, the bird's environment is more that of trunks, limbs, and undergrowth where it gathers most of its food, than of the forest floor, where in fact it is seldom seen.

YELLOW-BELLIED SAPSUCKER. *Sphyrapicus varius varius* (Linn.)

This Woodpecker, a little smaller than the Robin, is readily known by the red patch on the forehead, and in the male on the throat also. The Downy and Hairy Woodpeckers have red only on the back of the head. The center of the back is barred with black, and the wing shows a broad white patch, visible from a side view when the wing is closed, and a good field mark. Young birds that have no red, may be distinguished by this mark and the dark back. The pale yellow under parts are not usually a good field mark, as the habits of the bird make them inconspicuous.

The Sapsucker is rare in the Park. I saw only one, in the Big Basin on August 1. In summer the bird will be found mainly in forests, particularly those of larger trees.

The voice of the Sapsucker is not often heard. The commonest note is a cat-like "waaow," that reminds me of a similar call of the gray squirrel.

The nest is in a hole in a tree, usually rather high up. While generally beneficial as an insect destroyer, this bird is sometimes harmful, girdling or seriously injuring trees by its habit of drilling rows of holes through the inner bark to get the sap.

NORTHERN PILEATED WOODPECKER. *Phlæotomus pileatus abieticola* (Bangs)

This Woodpecker is unmistakable. Its large size, only slightly smaller than the Crow, its black back, red-crested head, white stripe on the side of head and neck, and white-marked wings are entirely characteristic. The females have less red on the head.

That this Woodpecker occurs occasionally, particularly in the more mature forests of the Park, is unquestioned. Several persons reported seeing it recently in the Park area, but I did not see one myself. Unmistakable signs of its work on the trunks of large dead trees were seen in the Big Basin, at the head of Red House Creek and in Browns Hollow, a tributary of Wolf Run. In the last case the work was fresh.

The call of this bird suggests in time and form the long call of the Flickers. It is louder and of different quality, however, sounding like "ho ho ho ho ho" many times repeated. The flight is usually undulatory like that of the other woodpeckers, although the contrary has been stated.

The nesting hole is similar to that of the other woodpeckers but with a larger opening. Places where these woodpeckers have been at work on tree trunks show deep rectangular holes chiseled into the wood, often running up and down the trunk for a foot or more.

BROWN CREEPER. *Certhia familiaris americana* (Bonap.)

In the summer of 1922 the Brown Creeper was added to the list of the summer birds of the Park. A single bird was seen on August 21 in the Big Basin on Stoddard Creek. This species may be easily distinguished from others by its small size, slender curved bill, finely striped brown back, pointed tail feathers, and habit of creeping spirally up the trunks of trees as far as the rough bark extends. It never creeps head downward as do the Nuthatch and Black and White Creeper. Its commonest note is a faint, high-pitched "shree-e-e-e," and in early summer it rarely sings a short, weak song of only four or five notes, suggesting the songs of the weaker voiced warblers.

2. *Birds of the Tree-tops.* Many birds live amid the foliage and twigs of the tree-tops (plate 28 and figure 86). Here they nest and search for their food, which in the majority of cases is insects. Most of these insects are caterpillars, leaf beetles or aphids, all injurious to forests.

The great amount of good these birds do is not often fully appreciated. A single experience in the Park will suffice to illustrate

this. One morning, July 21, just after having discovered my only Cerulean Warbler of the summer, I climbed up a hillside on the south side of Quaker Run. A slight ridge sloping down the hill had been cleared for pasture, leaving the edge of a nearly full-grown forest just below me, where I could look down into the tops of the trees (figure 87) with the morning sun at my back giving me the best possible light for observations. I soon heard and then saw a Parula Warbler, one of the most highly colored birds of this species I have ever seen. This bird caught a small caterpillar on the leaf of a butternut tree, took it to a larger limb where it pounded and then swallowed it. In a moment or two it caught another and repeated the performance. Then a female Blackburnian appeared and did the same thing.

Investigation showed that there were about a dozen butternut trees here, all of whose leaves were infested by caterpillars of some geometrid moth. Many holes had been eaten through the leaves, hardly one of which was without its caterpillar. As I sat below one dropped into the pages of my notebook and got folded between the leaves.

It looked as though the butternuts would soon be stripped of their foliage. But the birds were at work. One after another I found Magnolia, Black-throated Green, Hooded and Black and White Warblers; Red-eyed, Blue-headed, and Yellow-throated Vireos; Juncos; and a female Indigo-bird, all busy gathering caterpillars. A female Magnolia was followed by two young who ate as fast as she could feed them. A Junco was busy carrying her caterpillars to a spot where I suspected there was a nest full of hungry young. The abundance of bright-colored warblers reminded me of a spring morning in May, except for the fact that there were more females and young and singing was less in evidence.

About two weeks later, on August 5, I again visited this spot. Hardly a bird was to be seen and not a caterpillar. The butternuts were far from defoliated, showing no perceptible difference in appearance than formerly. The birds had done their work thoroughly.

RED-EYED VIREO. *Vireosylva olivacea* (Linn.)

The Red-eyed Vireo is about the size of the English Sparrow. It may be distinguished best from other Vireos or the several olive-green warblers by the dark line through the eye, the gray crown, white under parts without any tinge of yellow, and the lack of wing bars. The red iris is not easily made out in the field.

This is the commonest forest bird in the Park and is next to the Song Sparrow and Indigo Bunting in general abundance. It is found mainly in the maple and beech woods, but also occurs in oak and chestnut, and in shade trees—particularly maples—about farms and along roads. It lives amid the foliage, gleaning insect food from leaves and twigs.

The song of this bird is long-continued and persistent. It is made up of short phrases of one to five notes with a short pause

after each. These phrases vary greatly, and a little careful observation will show that each individual bird has twenty-five to thirty different ones, repeating certain of them frequently, but others more rarely. In this respect it differs from the Yellow-throated and Blue-headed Vireos, these latter birds having decidedly less variety. The voice is rather high-pitched, clear and musical, but monotonous in its persistence.

The nest is a beautiful pocket-shaped structure hung from the horizontal fork of a small tree or bush, three feet or more from the ground, but never near the top of a large tree. The nest is made mainly of bark, held together by spider web. Paper is put into it where nests are built near civilization, and the lining is of finer strips of bark.

BLACK-THROATED GREEN WARBLER. *Dendroica virens* (Gmel.)

Close observation of this little bird reveals yellow on the side of the head, with a somewhat dusky line through the eye and on top of the head, and a greenish back. The gray wings and tail are marked with white wing bars and tail spots. The throat is deep velvety black, and this mark extends back along the sides, ending in long, narrow black streaks. The breast and under parts are white. The female is somewhat duller in coloring.

This is by far the commonest warbler of the forested areas in the Park. Like the Magnolia and Blackburnian it shows a preference for hemlock trees, although its foragings are frequently extended to the upper branches of the hardwoods. Living most of the time in the tree-tops, it is more difficult to see than the Black-throated Blue, or even than the Magnolia.

We may most easily know of the presence of this warbler by its song, which has a more musical, ringing quality than most of the warblers, a sound that one soon associates with the forest depths. There are two distinctly typical forms. The first may be written "see see see see too ta," the first four notes of even, high pitch, the fifth note lowest, and the last medium. The other form may be written "see-ee-see-ee-dedeta." The first two notes are long-drawn-out, and the last three quick and short. The pitch varies with individual birds, the two long "sees" being of different pitch, sometimes the first and sometimes the second being lower. The "de de" notes are of even pitch usually, but not always higher than the first two; and the last note is short, low in pitch and often omitted entirely.

The nest of this warbler is most commonly placed in a hemlock tree. It is cup-shaped, made of strips of bark, and built in a fork of the limbs near the top of a small tree, sometimes in a large one, often among the lower limbs. I found such a nest near Limestone Brook, July 27. It contained young birds which the mother was industriously feeding.

SCARLET TANAGER. *Piranga erythromelas* Vieill.

The male of this bird with its brilliant red body and black wings and tail, is unmistakable when clearly seen. The female is less

easily identified. She is plain olive-green above and dull yellowish beneath with no special distinguishing marks. Her size—a little larger than the English Sparrow—and rather finch-like bill will help in identification, as they separate her from the Warblers that are somewhat similarly colored. Male birds in late August are curious looking, being patched in green, yellow and red as they change from summer to winter plumage, while early September birds may have the full winter plumage like the female, save that the wings and tail are black.

The Scarlet Tanager is a common bird in the forests of the Park, despite the prevailing idea that such a brilliant bird must be a rarity. It lives among the tree-tops in both maple-beech and oak-chestnut types of forest. The bird is not always easily seen because of the thickness of the foliage, but once the song is known, a visitor to the Park in early summer will realize how common the bird is.

This song is a rhythmic series of five to nine slurred notes, high-pitched and usually uttered in a rather coarse voice. To the beginner in bird study it may at first seem confusingly like the Robin's song. The rhythm is similar, but it usually lacks the liquid l- or r-like consonant sounds and is of harsher quality.

The nest is built in a low limb of a tree, 10 to 40 feet from the ground. Both nest and eggs look rather like those of the Rose-breasted Grosbeak, but the higher location will usually determine the owner if the birds are not seen.

CROW. *Corvus brachyrhynchos brachyrhynchos* Brehm

The Crow is the largest of common perching birds, being about 18 inches long, or nearly twice the length of the Robin. Its entire body is black, including the rather heavy bill.

This bird is exceedingly common in the Park, and may be seen or heard almost everywhere. It belongs to the forest, since that is where it nests, yet it flies long distances and visits farms, orchards, shade trees and open meadows in its search for food. In the forest it seems partial to pine wherever that tree grows, and any small cluster of white pines in the Park will be likely to contain two or three Crows' nests.

The common "caw" of this bird is well known, yet it is varied considerably. It may be a single short "cah" or a longer "ca-ah" slurred on the end. Various other notes of a guttural, squeaky and rattle-like quality are produced, particularly in spring, sounds not so well known. The bird has no notes that can be called a song.

The nest of the Crow is a large structure of sticks, placed near the top of a tall tree, preferably but by no means always, a pine. Nesting takes place early in the year and is likely to be over or nearly so by the time summer visitors reach the Park.

MAGNOLIA WARBLER. *Dendroica magnolia* (Wils.)

The plumage of the Magnolia Warbler is a veritable patchwork of black, yellow, blue-gray and white. The upper parts are mainly blue-gray with black patches on the cheeks and middle of the back,



Fig. 83. A Junco's nest, hidden amid the grass and buttercups in a pasture close to the edge of a forest.

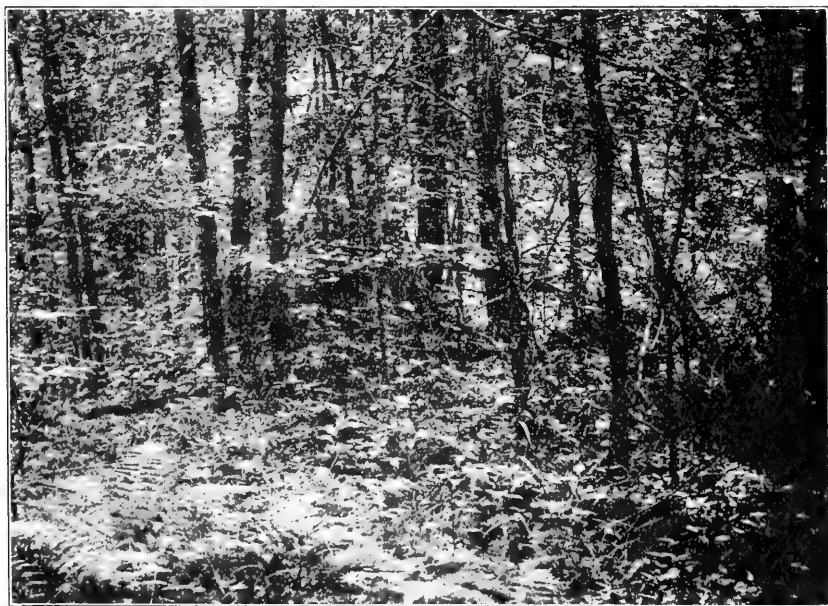


Fig. 84. Another view in the maple and beech forest, showing thick undergrowth of ferns, shrubs and young trees.



Fig. 85. The branches of a hemlock tree, where one may expect to find the Black-throated Green, Blackburnian and Magnolia Warblers.



Fig. 86. Among the tree-tops,—beech, sugar maple, birch and hemlock,—the home of Vireos, Warblers, and the Scarlet Tanager.

a white line back of the eye, broad patches of white in wing and tail, and a spot of yellow on the lower back. The lower parts are mainly yellow, decorated by a patch of black in the center of the breast, and numerous long black stripes, radiating from this breast patch, down along the sides and under parts. The female is similar to the male, but olive on the back and less brilliantly colored, while the young that are frequently seen in late summer are liable to be something of a puzzle. They are olive above, and yellow beneath, with a yellow spot on the lower back, white wing bars, and a few faint streaks on the sides.

The Magnolia is one of the common summer warblers of the maple and beech forest in the Park, second in numbers only to the Black-throated Green. It is one of the birds that show a decided preference for hemlock trees, though it by no means confines itself to hemlock alone, but gleans much of its food in the upper branches of maples, beech, birch and other broad-leaved trees.

The song of this bird is a short simple strain, often of not more than five notes. The pitch varies considerably in different individuals. Its simplest form may be written "weechy weechy wee." It is louder and stronger than the Black and White Warbler's strain, weaker and less emphatic than that of the Chestnut-side or Hooded. Neither does it have the husky quality that characterizes the Black-throated Blue, or the musical ring that makes the Black-throated Green so pleasing.

The nest is said to be usually placed in a hemlock, often in one of the lower limbs, but the only nest I located in the Park was in a small clump of wild red cherry almost underneath a hemlock, and about five feet from the ground. The last young bird to leave was sitting on the rim of the nest when discovered, and took its first flight as I approached.

BLUE JAY. *Cyanocitta cristata cristata* (Linn.)

This bird is between the Robin and Crow in size. The upper parts are brilliant blue, barred with black and marked with white spots on the wings and tail. The head is crested, and a black mark extends from back of the crest around the neck and across the breast. The under parts are white.

The Blue Jay is well distributed through the Park area, but seems less common than in most other regions I am familiar with. It lives mainly in the forest, but ventures out to more open country occasionally and may be seen in orchards and shade trees.

The Blue Jay is one of the noisiest birds in the woods, yet when it desires it can be so quiet that an observer never suspects its presence. The commonest call is a loud "meeah meeah" of a decidedly harsh quality. Some other notes are of a whistled quality, and still others with a squeaky sound. One call is almost exactly like the scream of the Red-shouldered Hawk. Once in a while a Blue Jay may be found producing a rather low pleasing twitter that is evidently a song, but one not indulged often, possibly only for a brief time during courtship.

The Blue Jay builds a rather large bulky nest in a tree or thick bush, at a height of six to twenty feet or more.

BLACKBURNIAN WARBLER. *Dendroica fusca* (Müll.)

It would be hard to decide which is the most beautiful of the wood warblers, but the Blackburnian, one of the smallest of the group, certainly ranks first in brilliance of coloring, with only the Redstart as a close rival. The male possesses a most brilliant orange throat, fading to yellow and finally white underneath, and striped with black along the sides. The upper parts are mainly black with patches of orange on forehead, crown and cheeks, stripes of duller orange in the back and patches of white in the wing and outer feathers of the tail. The female is similar, with a yellow, rather than orange throat, and of a brownish shade where the male is black.

Wherever there are groups of tall hemlocks in the maple and beech forest one should look and listen for this little Warbler. It is less common there than the other two, the Black-throated Green and Magnolia, and is perhaps more strictly confined to the hemlock, though it wanders occasionally to the tops of the hardwoods.

The song of this bird is best known by the fine, wiry, extremely high-pitched voice. Often, like the Parula Warbler's, it ascends in pitch toward the end; but this is not always true, and the finer quality and higher pitch of the "zee zee zee-ee-e-e" will usually distinguish it.

The nest is built in the branches of a hemlock tree, usually higher than those of the other warblers that make their home in that habitat.

WOOD PEWEE. *Myiochanes virens* (Linn.)

The Wood Pewee is a little smaller than the English Sparrow. It is dark gray above with prominent wing bars of whitish. The under parts are grayish white somewhat darker across the breast.

This bird is found in small numbers throughout the forested areas of the Park. It is perhaps a little commoner in oak and chestnut forest but is found in both kinds. It shows a marked preference for the more open woods and its margin, and is not likely to be found where the growth is dense. It lives among the lower limbs of trees, but not in the undergrowth.

The song of this bird when complete is often written "pee a wee-ee." The three parts are slurred together, the first usually highest in pitch, the second lowest and the last medium. Sometimes the bird sings only the first two notes "pee-ah" and again only the last two "ah-wee-ee." The last note is often given a slight upward slur of about half a tone.

The nest is saddled on a horizontal limb, and is a beautiful structure built of soft materials, lined with bark, and decorated on the outside with lichens. The eggs are marked with irregular blotches on the larger end.

BLUE-HEADED VIREO. *Lanivireo solitarius solitarius* (Wils.)

This bird, slightly smaller than the English Sparrow, is easily distinguished from the other Vireos by the blue-gray head, white mark from the bill around the eye, yellowish sides, and wing bars.

It is well distributed in the maple-beech forests of the Park, but not common anywhere. It seems to be more certain to occur in the few areas of large old trees than in second growth forest. It lives in the tree-tops like the other vireos, where it is difficult to see but easily heard.

The song of this bird is of the same general form as those of the Red-eyed and Yellow-throated Vireos, but distinguishable to a good ear. The phrases are less variable and numerous than the Red-eye's, but they are sweeter and less monotonous in quality. In fact, in sweetness of quality this Vireo is the best singer of its family. The phrases are from two to five notes each, a little slower than those of the Red-eye, and often ending in a sweet soft-toned, slurred note almost like the voice of the Bluebird. The bird lover will find greater pleasure in the song of this vireo than in any of the others.

The nest of this bird is placed in a tree and is similar to those of other vireos. The birds are often quite tame when incubating their eggs and allow a close approach.

PURPLE FINCH. *Carpodacus purpureus purpureus* (Gmel.)

This bird is about the size of the English Sparrow. The male is bright crimson pink on the head and lower back, and lighter pink on the breast. The wings, tail and upper back are brown. The female is brown, with a prominent broad cream colored stripe over the eye, cream colored wing bars, and a gray breast, streaked with brown. The female might be mistaken for the female of the Rose-breasted Grosbeak in the field, but the larger size and heavier bill of the Grosbeak should separate them.

The Purple Finch is not common in the Park, but occurs in small numbers both in the forest and along the stream valleys. Birds were seen in the hills back of Salamanca, in the lower Red House Valley about Tunesassa (Quaker Bridge) and on Limestone Brook. The bird lives in the tree-tops, getting most of its food among the twigs and terminal branches of the trees.

The song of the male is a sweet warble, varying greatly in individuals. It resembles the song of the Warbling Vireo, but is less regular in time and more inclined to contain short phrases of two or three notes repeated several times. The birds have a short call note which sounds like "pink," and is characteristic enough to be used as a means of identification when well known.

The nest is said to be placed in an evergreen, but the Park birds seem to show no great preference for such trees. I suspect that the nest might also be found in broad-leaf trees along the stream valleys in this locality.

NORTHERN PARULA WARBLER. *Compsothlypis americana pusilla* (Wils.)

This beautiful little bird is smaller than the English Sparrow. Its upper parts are a light grayish blue, with a patch of dull yellow in the center of the back, two prominent white wing bars and white spots on the outer tail feathers. The throat and upper breast are yellow fading to white underneath, and the breast of the male is crossed by bands of blackish blue and reddish brown. The extent and number of bands varies with the age of the bird.

The Parula Warbler is found locally in the Park, and is not common. I have met with it in but two places, one on English Run where a single male was seen July 16, about two miles above Frecks, and the other on the south side of Quaker Run not far from the Park's western boundary, where a bird was heard July 11, and at least three males singing July 21. The Parula Warbler lives mostly in the tree-tops of the forest where it is more easily heard than seen. Like other warblers it is an active little bird, hopping or flitting from branch to branch, and giving the observer only a casual opportunity to view its attractive plumage.

The song is high-pitched, shrill, and rather more buzz-like than musical. There are two common forms, but both run upward in pitch toward the end, and sometimes suddenly drop down for a single short terminal note. The first form is a single long buzz of this character, and the second is three shorter buzzes followed by a longer one.

In the nesting season the Parula Warbler is said to frequent places where *Usnea* lichen hangs from the branches of trees, placing its nest in such moss. No *Usnea* has been seen in the Park, and it may be that the Parula does not follow that habit in this region.

RED-TAILED HAWK. *Buteo borealis borealis* (Gmel.)

This hawk, in adult plumage, can always be distinguished by its reddish tail. Its shape and size will distinguish it from all but the Red-shouldered Hawk. The red tail is visible in good light, even when the bird is flying at a distance; for as it sails in great spirals the upper surface of the tail tips toward the observer revealing its distinguishing color when the bird tilts at the outer edge of each circle.

This is the commonest hawk in the Park and may be observed almost daily, while all others were seen only a few times each. It inhabits the forested hillsides but ranges far over the open country in search of food.

The voice of this hawk has a somewhat hissing quality like that of a steam whistle. It calls "ps-see-ee yoo-oo" in a long downward slur, longer than the Red-shoulder's call, and not usually repeated immediately. A rarer call, which I heard along Limestone Brook was of repeated notes, slurred upward, like "oolee oolee oolee oolee."



Fig. 87. A view of the tree-tops along the forest margin,—butternut, black birch and maple,—the characteristic haunt of Red-eyed and Blue-headed Vireos, Scarlet Tanager and various Warblers.



Fig. 88. Cat-tail marsh in the Tunungwant Valley. Home of the Red-winged Blackbird, Sora and Bittern.

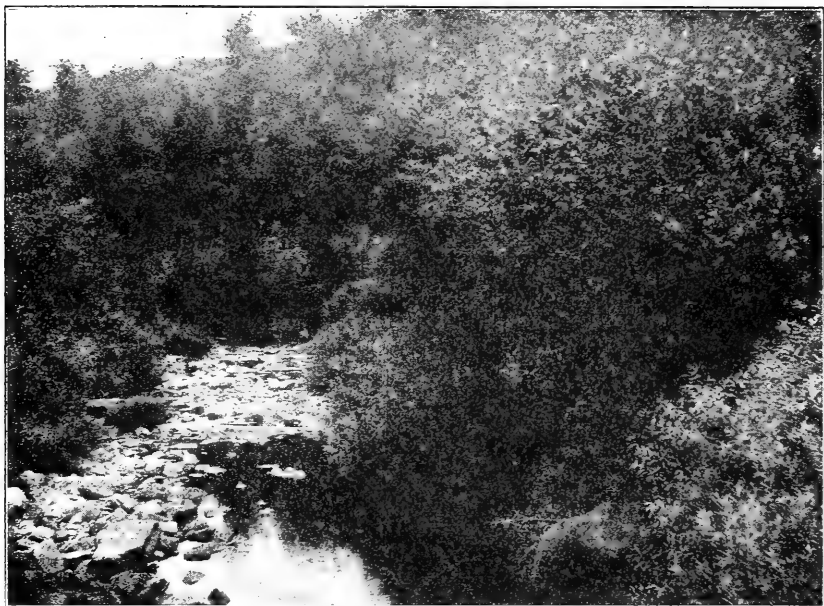


Fig. 89. Quaker Run, above Frecks, showing characteristic upland stream border, the home of the Song Sparrow, Veery, Maryland Yellow-throat, and Canada and Yellow Warblers.



Fig. 90. Quaker Run, near its mouth. Dense willow thickets, the home of Song Sparrows, Yellow Warblers, Catbirds, Redstart and Rose-breasted Grosbeaks.

The nest is a bulky mass of sticks in a tall tree. I suspected a pair nesting on a tributary of lower Quaker Run, but did not locate the site. Young birds, most probably of this species, were seen near that point and on the head of Pine Creek July 17 and 20.

BARRED OWL. *Strix varia varia* Barton

This is the only large owl that has been found in the Park. It is easily identified by its large size and round head without ear tufts, a point that will distinguish it from either the Horned or Long-eared Owls that may occur there. The general color of the plumage is grayish brown, barred above, lighter and barred and streaked below.

It is difficult to judge of the abundance of owls in a region, as they sit quietly in thick trees in the daytime and are likely to be overlooked. When smaller birds find them they usually advertise the fact by their excited cries. The two Barred Owls which I saw in the Park were discovered in this way. One in the Big Basin was found July 19 through the cries of an excited Wood Thrush, and the second near Quaker Run, August 5, through the unusual cawing of a flock of Crows.

The call of the Barred Owl is a deep hooting. Several "hoos" are repeated in regular time, with a downward slur on the last, a point that will distinguish it from a possible Horned Owl, whose notes are all on the same pitch, but less regular in time.

The nest is in a hollow tree or in the old nest of a Crow or hawk.

YELLOW-THROATED VIREO. *Lanivireo flavifrons* (Vieill.)

This bird is the most brightly colored of the Vireos, and easily distinguished from others by the clear yellow throat, white wing bars, greenish head, and gray wings and tail.

The Yellow-throat is rare in the Park. I met with it twice on the edge of a forest in the Quaker Run Valley, probably the same bird. It was reported by others in other locations and is likely to be found anywhere in the Park where there are forests or shade trees.

The song of this bird resembles that of the Red-eyed Vireo, but averages lower in pitch, with a peculiarly different quality, and is less variable. The phrases are commonly of only two or three notes each, and the pauses between phrases are longer than in those of the Red-eyed Vireo. Each individual possesses five to nine different phrases. Often for a long time it sings only two or three, repeating them over and over till they become monotonous.

The nest is not distinguishable from those of other vireos.

RED-SHOULDERED HAWK. *Buteo lineatus lineatus* (Gmel.)

This large Hawk is not difficult to distinguish from others except the Red-tailed Hawk, from which it can be separated by the darker reddish under parts, the reddish shoulders and the lack of a reddish tail. Young birds are difficult to identify. The voice will always distinguish the species, however.

It is less common in the forests of the Park than the Red-tail,

and I saw it only four times,—near Red House July 3, on Quaker Run July 18 and August 5, and near Limestone on July 27.

The call of this hawk is a high whistled scream, slurring downward, like “eeoh eeoh eeoh,” often repeated many times, and distinctly different in quality from the Red-tail’s call.

The nest is placed in a tall tree, and is merely a large mass of sticks. This hawk probably breeds in the Park but I have found no nests there. (See p. 350, addendum, for Sharp-shinned Hawk).

PINE WARBLER. *Dendroica vigorsi* (Aud.)

This little bird is the dullest of the yellow-colored warblers. It is dull yellow beneath, olive above, with white wing bars that will distinguish it from most other yellow and olive warblers. The male and female are nearly alike.

The Pine Warbler is rare in the Park, probably occurring only where an occasional clump of large white pine still remains in the deciduous forest. I met with but a single bird, on August 7, in just such a group of pines on the left of the road up Cain Hollow. I had previously visited this place on July 11 without discovering it. The bird was first located by its trill, unexpected at so late a date, but perhaps the autumn period of song was already beginning.

The song resembles those of the Chipping Sparrow and Junco and comprises twelve to fifteen rapid notes, all equal in time, and not especially musical. The pitch varies, the song moving slightly up and down the scale in an irregular manner. This character distinguishes it from either the Chipping Sparrow or Junco.

The nest is built in a pine tree and is constructed of bark, leaves and fibres. It is often at a considerable height from the ground.

BIRDS OF THE MARSHES

Marshes are not common in the Park. Here and there in the stream valleys are small areas that can be classed as such, but only in the Tunungwant Valley are there any large enough to attract marsh inhabiting birds other than the Red-winged Blackbird. Marsh lands are of two distinct sorts,—grass marshes, and cat-tail marshes. They occur along bayous that mark a former course of the stream.

Grass marshes develop where the water is rather shallow, or where the ground is wet but overflowed only part of the year. The characteristic plants comprise the various sedges (*Carex* and *Cyperus*) rushes (*Juncus*), cut-grass (*Homalocenchrus*), water plantain (*Alisma Plantago-aquatica*), arrow-head (*Sagittaria latifolia*), water hemlock (*Cicuta maculata*), blue flag (*Iris versicolor*), marsh violet (*Viola cucullata*), cardinal-flower (*Lobelia cardinalis*) and others. The cat-tail marshes (figure 88) occur where the water is deeper, and consist mainly of the cat-tail (*Typha latifolia*). Beneath the cat-tails grow a few other water plants, such as yellow pond lily (*Nuphar advena*), water pepper (*Polygonum hydropiperoides*), water dock (*Rumex Britannica*) and spearwort (*Ranunculus laxicaulis*).

Marsh birds like both kinds of habitats, but nest more frequently among the cat-tails as they furnish better protection and concealment. Only three species of birds that have been found in the Park properly belong to the marshes, but there are many other possibilities left for future discovery, including the other rails, the marsh wrens, Swamp Sparrow and Least Bittern. Species listed under other headings that often haunt the marshes are Black Duck, Great Blue Heron, Green Heron, Marsh Hawk, Meadowlark and Bronzed Grackle.

RED-WINGED BLACKBIRD. *Agelaius phœniceus phœniceus* (Linn.)

This bird is a little smaller than the Robin. The male is entirely black, except the shoulder of the wing which is brilliant scarlet red, edged with pale yellow. This mark is always visible in flight or when the wing is spread, but may be concealed when the bird is quiet, with wings folded. A singing bird, however, has a habit of spreading the wings and lifting the shoulders, so that in such cases it cannot be mistaken. The female and young are of a plain brownish color, striped above and below.

The Red-winged Blackbird is well distributed in open country in the Park. It prefers swampy areas, and borders of slow-moving streams. Cat-tail marshes are its favorite home, but where there are no cat-tails it is found in open, sedgy marshes, or in bushes and trees along their margin.

The song of the Red-wing has been well represented in its most typical form by the syllables "conqueree," the last note a long trill. The commonest call is a harsh "chack," but when one approaches the nesting site it utters an alarm note "pee-ah" and less commonly a rather mournful "whee-ee-ew."

The nest is placed in cat-tails a foot or two above the water of a marsh, or in a tussock of grass, or more rarely a bush, growing in a marshy situation. Nests were common in the cat-tails about Limestone. They are made of coarse grasses, and the bluish eggs are marked with curious black scrawls and streaks.

BITTERN. *Botaurus lentiginosus* (Montag.)

The Bittern is larger than the Crow, with long neck and legs, and a long, sharp-pointed bill. It may be distinguished from the Great Blue Heron and Green Heron by its brown, striped plumage, and by its size,—smaller than the former but considerably larger than the latter.

It has been found in the Park only in the Tunungwant Valley, where a single bird was seen July 25 and again July 27. It lives in the marshes among the grasses and cat-tails, or about bayous along the stream borders (figure 91).

While the Bittern is usually silent, it sometimes when startled emits a hoarse cry. In spring, in regions where it nests, it makes a curious pumping noise sounding like "pumper lunk — pumper lunk," the sound often being uttered at night and carrying a long distance.

The nest is usually concealed among the cat-tails of a marsh. If this bird is found nesting in the Park it will probably be in such areas in the Tunungwant Valley. It sits closely on its nest, with bill pointing upward, so that the striped neck and long bill blend with the reeds and cat-tails and make it difficult to see.

SORA; CAROLINA RAIL. *Porzana carolina* (Linn.)

This little bird, smaller than the Robin, can be identified by its long neck and legs, large greenish yellow feet, olive-brown back, and gray under parts, with a black mark on the chin and throat. The heavy, labored flight, and the way in which it drops out of sight into the reeds or grass are also characteristic.

The Sora occurs in the cat-tail marshes of the Tunungwant Valley where one was seen and several heard, July 24 and 27. It is a difficult bird to detect when hiding among the cat-tails and it flies only when closely approached.

The voice of the Sora is rather high-pitched and squeaky. One call has been written "kur-wee." Another is a longer call, the notes descending in pitch, while a single short "kek" is sometimes heard.

The nest is placed among the cat-tails or grasses of the marsh, the bottom just above or sometimes in the water. The grasses standing above the nest are often woven together, concealing it and its contents effectually. It probably makes its home in the Tunungwant Valley marshes where the nest or downy black young may some day be found.

BIRDS OF THE WATER MARGINS AND LOWLAND THICKETS

The vicinity of streams and ponds is always attractive to birds. Some birds live their entire lives in or about water. Others are attracted thither from time to time for gleaning food, bathing or drinking. Aquatic animals, insects or plants form the food of some species. Flying insects gather more abundantly near water and attract swallows and others. As a general rule bird life will always be more abundant near water than elsewhere.

In the Alleghany Park the water resources consist of brooks (figure 89) and somewhat larger streams, and just outside of the Park, the Allegheny River. The ecology of the stream margin is unusually interesting because of the varied conditions. In general, we can divide the bird life into two divisions,—birds that live along the more open stream border, and birds that live in the thickets of bushes, trees or vines that grow along the stream border.

Birds of the Shoreline and Open Banks. The open stream border consists of the shallow water along the shores, and the shores themselves, whether stony or muddy bars, or steep clay banks. Vegetation is not so much the attraction here as the life in the water or along the shore that furnishes food, and the nesting sites found along the banks.

In the Tunungwant Valley the stream is slower moving, with more muddy shores. Near the stream occur bayous (figure 93),

portions of the former course of the stream now cut off, where the water is more or less shallow. Some of these bayous belong more properly to the marsh type. In others the water is too deep to be characterized as marsh, but is filled with water plants such as arrow-head (*Sagittaria latifolia*) and yellow pond lily (*Nuphar advena*).

Birds found occasionally along open shorelines and bayous, not listed here, are the Bittern, Green Heron, Crow, Red-winged Black-bird and Bronzed Grackle.

SPOTTED SANDPIPER. *Actitis macularia* (Linn.)

This is the only Sandpiper to be found in the Park throughout the summer, and is easily distinguished by its small size—a little larger than the English Sparrow—and its long bill and legs. The long, pointed wings show a white stripe lengthwise when spread in flight. The back is brownish gray, faintly spotted with black, and the breast of adult birds is heavily spotted with the same color.

It is quite common along the shore of the Allegheny River, and also on the larger streams of the Park such as Quaker Run and Red House Creek. It lives on the stony bars that border the stream.

The notes of the Sandpiper are a high-whistled "peet" or "peet-weet." In early summer this is varied by a longer call "weet-weet-weet-weet—peeterweet-peeterweet-peeterweet" sometimes reversed with the "peeterweet" notes first. This long call is uttered by the male as a song, and in a softer, lower voice by the female as a means of calling her young together.

The nest is simply a slight depression in the ground, lined with a few grasses. The three or four dark olive eggs, blotched with black, are large for the size of the bird. The downy young run about soon after they are hatched and look like small gray chickens with abnormally large feet.

BELTED KINGFISHER. *Ceryle alcyon alcyon* (Linn.)

This bird, considerably larger than the Robin, is easily distinguished from all others by the large, irregularly crested head, the long straight bill, and the gray-blue plumage with collar of white about the neck.

The Kingfisher is quite common in the Park, being always found near streams, either sitting on a dead limb or tree in a conspicuous place where it can watch the water; or hovering over the water, or diving into it bill first, for some small fish that its keen sight has detected.

The characteristic note is a long rattle-like call, easily distinguished from those of all other birds, but resembling the long call of the Hairy Woodpecker.

The nest of this bird is made at the end of a long tunnel excavated in the bank of a stream. The openings of several such burrows, probably those of Kingfishers, were seen in banks along Quaker Run and Red House Creek. A brood of young birds just from the nest was seen on Quaker Run, August 4.

ROUGH-WINGED SWALLOW. *Stelgidopteryx serripennis* (Aud.)

The brown back will distinguish this Swallow from all others except the Bank Swallow, and the gray throat and lack of a brown chest band distinguish it from that species. These marks are easily made out in perching birds but are hard to distinguish when they are in flight. With many bird lovers there seems a tendency to overlook this species and speak of all brown-colored Swallows as Bank Swallows, when distinguishing marks cannot be seen. In the Park as well as in most other places, it would be safer to assume them Rough-wings, unless certainly identified as the other species.

This bird is not uncommon in the Park, although less numerous than the Barn and Cliff Swallows. It is a bird of the air, but is commonly to be found where steep clay banks border a stream. It occurs frequently in parts of the Red House Valley, nests in small numbers along Quaker Run, and has been seen west of Limestone.

The commonest note of this bird is not like the twitter of other Swallows, but a single rather harsh, long note. This note is often repeated several times, rapidly.

They nest in a clay bank in a hole either excavated by the birds themselves, or formerly used by a Kingfisher. In some regions they have been found nesting in crevices of stone walls, or the ends of iron pipes. The entrance is usually larger than in the case of the Bank Swallows; and there is likely to be but a single nest or two or three together, rather than a large colony such as Bank Swallows build. Young, out of the nest, were found on July 4 perched in a dead pine along Red House Creek, where the parents were bringing them food.

KILLDEER. *Oxyechus vociferus* (Linn.)

This bird may be easily known by the white collar around its neck and the two black bands across its breast. Its habits are somewhat like those of sandpipers, but its larger size and shorter bill instantly separate it. The lower back shows a cinnamon-colored patch as the bird flies, and the wings are long and pointed.

The Killdeer lives on the stony bars of streams in the Park and along the Allegheny River. It also inhabits open fields, particularly those near streams. I found it common along the river, and a few birds were seen on Red House Creek, Quaker Run, and near Limestone.

The voice of the Killdeer is as characteristic as its plumage. The loud, shrill "kill-dee-ee kill-dee-ee" is well known. When the nest is threatened it produces another note, a trilled "tr-r-r-r-r-r."

The nest is similar to that of the Spotted Sandpiper, but with somewhat larger eggs. The downy young, even when first hatched, are marked with the black breast bands of the adult.

GREAT BLUE HERON. *Ardea herodias herodias* Linn.

This bird may be known by its large size, gray-blue plumage above, and long neck and legs. The head is drawn in and the legs are held outstretched when in flight. Adults have the center of the crown

white, bordered by black lines, but in young birds the entire top of the head is black.

This heron occurs occasionally in the Park, and along the Allegheny River in late summer. It probably does not nest in the locality, all the birds being wanderers from some distant nesting colony. Birds were observed along the river, near Tunesassa on August 3 and near Red House on August 13. Others reported the bird in the Park area along Quaker Run in late July.

The voice of the Great Blue Heron is not often heard. It is a loud, harsh squawk, much lower in pitch than that of the Green Heron. People living near the Park commonly refer to this bird as a "Crane." The true Crane is exceedingly rare anywhere in eastern United States and unknown in this region.

HERRING GULL. *Larus argentatus* Pont.

The Herring Gull may be known by its large size, considerably larger than the Crow, and its long wings, usually somewhat curved in flight. Adults may also be known by the white and light gray plumage, with black-tipped wings. The back and wings are gray, and head and tail white. Young birds are dull grayish brown with black tails, and various intergradations between this plumage and that of the adult are to be found.

This bird occurs as a late summer straggler along the Allegheny River, and has not been seen inside the Park boundary. It probably nests nowhere in the region, and is said to occur along the river mainly when the water is high. Birds were seen there July 13 and 30, both times after a heavy rain the day before had somewhat swollen the river.

The voice of this bird is loud, high-pitched and shrill. The commonest call sounds like "keeyo keeyo keeyo," but it has a great variety of other notes.

BANK SWALLOW. *Riparia riparia* (Linn.)

This bird is easily told from all its relatives except the Rough-wing by its plain brown back. The white throat and the brown chest band distinguish it always from the Rough-wing, as even young birds fresh from the nests possess this mark.

The Bank Swallow is rare in the Park. Whether it nests there or not is uncertain. No nesting colony was found, and observations were limited to three birds near Limestone, one on July 23, and two on July 26. There may be a colony somewhere in that vicinity from which these birds had strayed. Where a colony is found many birds are likely to be seen in the immediate vicinity.

The notes of this Swallow are rather harsh like those of the Rough-wing. There is, however, a difference between the notes of the two species, not easily described yet distinct when once learned.

The nest of the Bank Swallow is built in a hole in a clay or sand bank along a stream border or in an old clay pit, or cut along a railroad or highway. The birds always nest in colonies, often large ones, with the openings of the nests quite close together, so that the bank appears riddled with holes. The entrances to the nests are smaller than those of the Rough-winged Swallow.

BLACK DUCK. *Anas rubripes* Brewst.

The Black Duck is the only species of duck at present known in the Park in summer. It may be distinguished by the general blackish color, with white wing linings showing in flight. The bluish speculum of the wing is difficult to see in the field, but the lack of a white border as well as the general darker color will distinguish it from a female Mallard, should that duck occur in the Park. Ducks may be known from Herons when in flight by the outstretched neck.

The Black Duck has not been found in the Park area itself, but a flock of these birds was seen on the Allegheny River near Cold Spring, July 15. It is likely to occur along the larger streams in summer, and may nest somewhere in the area.

The common note is a "quack" not noticeably different from that of the domestic duck. It also makes a whistling noise with the wings when in flight.

The nest is hidden in tall grass or bushes on the ground, usually near water. The eggs are dull greenish white or buff color and six to twelve in number.

BALD EAGLE. *Haliaeetus leucocephalus* (Linn.)

This great bird is unmistakable in adult plumage. The blackish brown body and wings, and pure white head and tail are easily made out from a long distance. The Osprey, sometimes mistaken for it, although really very different, has the white head marked with black lines and lacks the white tail. Young birds are entirely blackish brown and might be confused with the dark phases of some of the larger hawks.

A single adult bird of this species was seen along the Allegheny River near the mouth of Wolf Run on August 2. Evidently the same bird, for a feather was missing from the right wing in each case, was seen near the mouth of Quaker Run on August 5. Others reported seeing an Eagle in this vicinity, mainly along the river, but two reports were from upper Quaker Run within the Park area, where I did not see it personally. Whether the bird belongs to the northern or southern race could not be determined, so I have left the name binomial in form.

The voice of the Eagle is not often heard. It is high-pitched and shrill, several notes in quick succession, and is said to be different in the two sexes. I have never heard it except from a captive bird whose sex was doubtful.

The nest of this bird, a large mass of sticks, is placed in a tall tree or on a cliff. If any should be found in the Park, it would be in a tree, as there are no cliffs there.

Birds of the Stream Thickets. In the more moist ground that borders streams of the Park, vegetation is of a different character than elsewhere. Bird life in such places is correspondingly different, some species occurring only in such areas and others being more common there.



Fig. 91. Bee balm flowers; a special attraction for the Hummingbird in Allegany Park.



Fig. 92. Turk's-cap lilies. Occasionally visited by Hummingbirds in the Park.



Fig. 93. Bayou in the Tunungwant Valley, showing yellow pond lilies and other swamp vegetation. Haunt of Green and Great Blue Herons, and Bittern.



Fig. 94. One must study his birds quietly, avoiding quick motions and keeping all his senses alert. View in oak and sassafras woods west of Wolf Run.

While there are many trees growing along the streams, there are no areas of forest. Most of the stream border vegetation is to be classed as thicket consisting mainly of shrubs and vines with open spaces between, grown with grasses and tall herbaceous plants (figure 90).

The trees of the stream border are chiefly elm (*Ulmus americana*), silver maple (*Acer saccharinum*), red maple (*Acer rubrum*), yellow birch (*Betula lutea*), buttonwood (*Platanus occidentalis*), several willows (*Salix*) and an occasional swamp white oak (*Quercus platanoides*). Other species of trees often grow near the river or other streams but generally only where the true forest types approach the margin of the stream.

Shrubs found along the streams comprise willows (*Salix*) of several species, elder (*Sambucus canadensis*), alder (*Alnus rugosa*), red and black raspberries (*Rubus strigosus* and *R. occidentalis*), blackberries (*Rubus*) of several species, wild roses (*Rosa*) and arrow-wood (*Viburnum dentatum*). The vines that climb over these shrubs and help to produce dense thickets that form the nesting sites for most of the birds of this association are river grape (*Vitis vulpina*) and virgin's bower (*Clematis virginiana*).

The herbaceous plants of the stream border comprise numerous species, some of which are especially attractive to birds as furnishing nesting sites or food supplies, others having perhaps no special relation to bird life. These species in approximate order of abundance are sedges (*Carex* and *Cyperus*), pale and spotted jewelweeds (*Impatiens pallida* and *I. fulva*), sensitive fern (*Onoclea sensibilis*), New York fern (*Aspidium noveboracense*), bee-balm (*Monarda didyma*), tall meadow rue (*Thalictrum polygamum*), interrupted and cinnamon ferns (*Osmunda Claytoniana* and *O. cinnamomea*), Joe-Pye weed (*Eupatorium purpureum*), turtlehead (*Chelone glabra*), dog violet (*Viola canina*), monkey flower (*Mimulus ringens*), ostrich fern (*Onoclea struthiopteris*), nettles (*Urtica*), boneset (*Eupatorium perfoliatum*), Canada and Turk's-cap lilies (*Lilium canadense* and *L. superbum*), cardinal flower (*Lobelia cardinalis*), fringed loosestrife (*Steironema ciliatum*), false hellebore (*Veratrum viride*) and skunk cabbage (*Symplocarpus foetidus*).

In addition to the birds listed in this association, the following species, discussed elsewhere, also occur: Woodcock, Downy Woodpecker, Flicker, Kingbird, Least Flycatcher, Crow, Cowbird, Red-winged Blackbird, Baltimore Oriole, Bronzed Grackle, Towhee, Indigo Bunting, Cedar Waxwing, Warbling Vireo, Brown Thrasher and Robin.

SONG SPARROW. *Melospiza melodia melodia* (Wils.)

This bird, about the size of the English Sparrow, is best identified in the field by the streaked breast with a large dark spot in the center, heavy streaks on either side of the throat, and the lack of wing bars.

The Song Sparrow is, I believe, the commonest and most widely distributed bird in the Park. While it belongs primarily to the stream valleys, it is likely to be found everywhere except in the forest itself. The bushes along streams are its favorite habitat, but open meadows, wet grassy marshes, thickets, and the edges of orchards or forests are all likely to have Song Sparrows inhabiting them.

This bird is well named. While not the best singer in the Park, its song is decidedly pleasing, more variable perhaps than that of any other bird, and has a wide range in pitch. It sings more persistently and continuously than any other species. The song is more musical than that of the Savannah, Grasshopper or Chipping Sparrows, more varied in pitch than that of the Field Sparrow, and begins with shorter, quicker notes than that of the Vesper Sparrow. Perhaps the commonest form of song begins with three short notes on the same pitch, followed by a trill on a different one, but there are many other forms of beginning.

The nest is most commonly found on the ground in a tussock of grass or beneath a bush. It is sometimes in a bush a few feet from the ground.

MARYLAND YELLOW-THROAT. *Geothlypis trichas trichas* (Linn.)

This little bird, considerably smaller than the English Sparrow, may be known by the dark olive back, bright yellow throat, and black mask-like patch about its eyes. The upper side of this black patch is bordered by light gray and the under parts shade to dull white. The females and young are liable to be a bit puzzling, in plain olive and yellow and without the distinguishing black mark. The female should not be confused with the Nashville Warbler, a bird I have not found in the Park, although it may occur there.

The Maryland Yellow-throat is abundant in the Park, inhabiting the dense growth of willows and other shrubs found along the stream borders, and also common in thickets, particularly those of somewhat moist soil. They are particularly fond of tangles of thorny bushes, such as blackberry, raspberry and wild rose.

The song of this bird is distinctive. It is composed of three or four repetitions of a phrase of from three to five notes. This phrase varies up or down in pitch, and one note of it is usually strongly emphasized. The common interpretation "witchery, witchery, witchery" represents a song of three-note phrases, the first accented. This song sounds to me more like "witatee witatee witatee." Another song of four phrases, the second accented, may be represented by "terwitatee" repeated, and another accented on the last note "titawittee." Many other variations will be noted by observers, but they all bear a strong resemblance to one another. Once the song is well known, it cannot easily be mistaken for that of any other bird. There is a slight resemblance to the less regular song of the Canada Warbler, but not sufficient to confuse the birds if one's ear for bird songs is good.

The nest of the Yellow-throat is placed on or very near the

ground, at the base of a bush, in a tangle of blackberry or in a tuft of sedge grass. It is made of grasses and leaves, and lined with fine grasses. When the young are out of the nest, the parents become anxious at the approach of an intruder, and advertise the fact to the knowing bird lover, who may find the young ones by a little patient waiting.

CATBIRD. *Dumetella carolinensis* (Linn.)

The Catbird is a little smaller than the Robin. Its plumage is plain gray, both above and below, with a black crown on the head, and a patch of dark reddish brown on the under tail coverts. It is a rather short-winged and long-tailed bird with a long sharp, slightly curved bill.

The Catbird is common in the Park, living in thickets and low dense shrubbery, particularly where they grow along streams. It is not a difficult bird to see, for it is often curious enough to come out into view to watch man as much as he may like to watch it. When concealed in the thick bushes its presence may often be known by the harsh, cat-like "mew."

The song of the Catbird is long continued and much varied. It is made up of short phrases with pauses between them. It is usually musical, but some notes may be harsh or nasal in quality. Frequently an individual interpolates into its song, portions of the songs of other birds; a phrase from the Wood Thrush, a few "teachers" from the Oven-bird, a perfect "whip-poor-will," and various other imitations. There is, however, little danger of mistaking the Catbird for some species that it imitates, for its imitations are mixed in with characteristic notes from its own song.

The nest is seldom more than three or four feet from the ground. It is placed in a thick, thorny bush or tangle of vines, and is constructed of sticks and leaves, and lined with fine roots. The eggs are dark greenish blue, unmarked or spotted, and usually four in number.

YELLOW WARBLER. *Dendroica æstiva æstiva* (Gmel.)

This is one of the best known members of the Warbler family. It is smaller than the English Sparrow, with a bright yellow color over most of its body, this yellow being somewhat duller on the back, wings and tail. The breast of the male is streaked with bright brownish red, but that of the female is unstreaked.

Unlike most of the warblers this bird is not to be found in the forest, but inhabits the willow and elder bushes that border streams. It is common along the banks of the Allegheny River and in all the lower stream valleys in the Park.

The song of the Yellow Warbler is a short, pleasing strain, although this bird, like most of the warblers, does not rank high as a singer. The song varies considerably, but the commonest form heard in the Park consists of four or five notes of even time and pitch, followed by three or four more of shorter time and slightly lower pitch, and terminating in a single note of the same time and

pitch as the first notes. It might be written "swee-swee-swee-sweete-te-swee."

The majority of Yellow Warbler nests are placed in elder bushes four or five feet from the ground. I have occasionally found them lower than this in a wild rose, or as high as ten feet in a small elm tree. The nest is woven into a crotch, and made mostly of plant fibres of a silvery whitish color. The four or five creamy white eggs are beautifully wreathed with dark spots about the larger end.

VEERY; WILSON'S THRUSH. *Hylocichla fuscescens fuscescens* (Steph.)

The Veery may be distinguished from the other thrushes by the uniform light tawny brown of the upper parts and the faint light brown spots on the nearly white breast and throat. The spots of the breast are so light as to be invisible a short distance away, and the bird in the dim light of a dense thicket appears to be pure white and unspotted beneath.

It is fairly common in the denser and more wooded stream borders of the Park, living in somewhat swampy woods or willow thickets. Unlike the other thrushes it is not found in the hillside forests, except where there are streams. It is quite common about Frecks and at other points in the Park characterized by lowland thickets.

The Veery is a beautiful singer, with a song quite unlike those of the other Thrushes. It consists of four to six phrases repeated rapidly "wreoo-wreoo, wreoo, wreoo," each phrase descending in pitch, the latter phrases beginning and ending on slightly lower pitches than the first. There is an unusual, weird, resonant quality to the song that gives it much of its charm. This bird sings less frequently than the other Thrushes and ceases earlier in the summer. After the song period it may be found by its call note, a short "wheo," which when imitated successfully will often bring the bird near enough for observation.

The nest is placed on the ground in wet woods or thickets, in or under a tuft of grass, or in a clump of ferns or some similar situation. The nest is attractive looking, woven of strips of bark and leaves, and containing three or four deep greenish blue, unspotted eggs.

CANADA WARBLER. *Wilsonia canadensis* (Linn.)

The beautiful little Canada Warbler differs from most of the other yellow-breasted Warblers in that the color of the upper parts is bluish gray and not olive. The bright yellow under parts are crossed on the lower throat by a band of black streaks, arranged like a necklace. The yellow extends upward on the side of the head to form a ring around the eye. The forehead of the male is spotted with black, and the black necklace of the female is fainter and less easily perceived than that of the male.

This bird is well distributed in the Park, but not especially common anywhere. I met with it most often in the thickets along Quaker

Run, particularly about Frecks, but it is also to be found on Red House Creek, Wolf Run and Limestone Brook, and probably other places. It prefers thickets of willow and elder that grow along streams, and is characteristic of the stream border type.

The song is loud and clear and made up of short, quick notes, varying up and down in pitch. At intervals certain notes are accented. There is a suggestion in the song of that of the Maryland Yellow-throat, but the rhythm is never so regular, and one may always feel sure that while the bird sounds something like a Yellow-throat, it is not that species. There is enough variation so that syllables written for the song of one bird, are not likely to fit the song of many other individuals. Thus Silloway ('20, p. 94) writes "chip, chippery, chippery, chippery, chee-teh-chee" for the song as heard in the Palisades Park. A song I heard in the Allegany Park was written "chip e wah chee taychee chip e wah," the two "chee" notes being highest in pitch, but the "tay," though low, loud and accented.

The nest is hidden on the ground, under the roots of a bush or in a bank. It is made of leaves, bark, moss or roots, and contains four or five spotted eggs.

RUBY-THROATED HUMMINGBIRD. *Archilochus colubris* (Linn.)

This bird is easily identified by its diminutive size; its long, slender bill; its quick darting flight,—now poising in the air, now darting to another spot so quickly that the eye can hardly follow; and the humming noise produced by the little wings, moving so rapidly as to be visible only as a blur. The metallic colorings,—green, white, and in the male, red,—are less valuable field marks than the shape and the habits of flight, for under different light conditions they appear to be various colors.

The Hummingbird is quite common in the Park, in fact more so than in any other region I am acquainted with. It inhabits mainly the edges of forest and thicket growths along the streams. In such places the bee balm (*Monarda didyma*, figure 91) grows commonly, and it may be the abundance of this flower that accounts for the abundance of Hummingbirds. The birds may frequently be seen hovering about the flowers. Several times I saw birds the top of whose heads appeared golden yellow, so covered were they with the pollen of this flower, the stamens and pistil of which are arranged so as to brush the head of the visiting hummer. In the Tunungwant Valley the cardinal flower (*Lobelia cardinalis*) is common, and is another favorite of the Hummingbird. This flower, though in no way related to the *Monarda*, is also red in color, with stamens and pistils similarly arranged to brush the bird's head and in that way insure pollination. A third flower sometimes visited was the Turk's-cap lily (*Lilium superbum*, figure 92) but this flower only dusts the hummer's breast with its dull red pollen, and it seems more commonly visited by butterflies than Hummingbirds.

The Hummingbird has no song, and only a few squeaky notes not

commonly heard. Its nest is a beautiful structure of soft materials such as fern wool, saddled on a horizontal limb, and decorated on the outside with lichens. Two nests were found in the Park, one on Quaker Run, July 14, and the second in the Tunungwant Valley, July 22. Both nests contained young, and I watched the mother bird feeding them by the curious process of regurgitation.

GREEN HERON. *Butorides virescens virescens* (Linn.)

This bird is the smallest of the heron family to be found in the Park. In the field it most frequently appears to be blue or greenish blue, but actually the color is green. This color is found on the back, wings and top of the head, while the neck is reddish brown on the back and sides, and white, striped with reddish brown underneath.

It is common in the trees and bushes bordering streams throughout the Park, and may often be seen standing on the bank of a stream or pool or wading in the shallows. When in flight the long neck is usually drawn up, and the yellow legs extended, making it appear not so long-necked a bird as it really is.

The common call of the Green Heron is a high-pitched, loud, and rather squeaky "kuleup," uttered when the bird is startled from its haunts.

The nest is a flat platform of sticks, placed in a small tree or bush near the stream. When the young are several days old they leave the nest and climb among the tree-tops, often sitting in a row on a branch, awaiting the approach of the mother with food. Such a family of young was observed being fed in a tree on the bank of Wolf Run, July 18.

YELLOW-BILLED CUCKOO. *Coccyzus americanus americanus* (Linn.)

Cuckoos are easily distinguished from other birds by their size, slightly larger than the Robin, their long tails, and plain-colored plumage,—brown above and white below. Separating the two species of Cuckoo, the Yellow-billed and the Black-billed, is more difficult. When perching, the former may be known by the large white spots on the under side of the tail, the yellow-colored bill, and the lack of red about the eye. When flying, the cinnamon-brown color that flashes in the wings will distinguish it.

This bird is fairly common in the Park, occurring most frequently in trees or bushes along the stream border, but also in thickets and along the edges of forests. Cuckoos are not always easily seen, but judging by its notes the Yellow-billed was a little commoner than the Black-billed species.

The commonest call of this Cuckoo is a long one, like "cuk-cuk-cuk-cuk-cuk-cuk-cuk-cow-cow-cow," with the time retarded at the end. Not only the time of the call, but the quality of voice in this bird differs from that of the Black-billed Cuckoo, being harsher and the notes less like a gurgle.

The nest of this bird is usually hidden in a thick bush or tangle of vines. It is made of sticks, and is poorly constructed and almost

flat. The eggs are unmarked and lighter blue than those of the Black-bill.

BLACK-BILLED CUCKOO. *Coccyzus erythrophthalmus* (Wils.)

This bird is very similar in general appearance to the Yellow-billed Cuckoo, but may be distinguished by the black bill, smaller white spots on the under side of the tail, red eye-ring, and lack of cinnamon color in the wing when in flight.

It is fairly common in the Park, but evidently slightly less so than the Yellow-billed Cuckoo. It occurs in similar places, in bushes or trees mainly along the stream borders, but to some extent in thickets or the edges of forests.

The notes of this Cuckoo differ from those of the Yellow-billed both in time and quality. They have a soft gurgling sound like "glug" rather than "cuk," and are grouped in pairs or threes repeated at even intervals of time. "Glug-glug—glug-glug" or "glug-glug-glug—glug-glug-glug," with one note of each group accented, and the whole repeated over and over, will represent the song.

The nest, like that of the Yellow-bill, is a poorly made platform of sticks, placed in a thick bush or low tree. The eggs are darker blue than those of the preceding species.

ROSE-BREADED GROSBEAK. *Zamelodia ludoviciana* (Linn.)

This striking bird is slightly smaller than the Robin. The black and white male, with its rose-pink breast and heavy beak can hardly be mistaken for any other bird. The female is brown with a striped breast and rather broad light stripes over each eye. Her coloring closely suggests the female Purple Finch, but her larger size and heavier bill will identify her.

The Grosbeak is widely distributed in the Park, but not especially common. In early July at least three males were in song above Frecks. Other birds were seen in the upper Red House Valley, at Wolf Run and on Limestone Brook, but none was noted near Salamanca. It is an inhabitant of bushy thickets and small trees along streams. It does not live much on the ground as other thicket inhabiting birds do, but mainly in bushes or the low branches of trees.

The song is a beautiful one, exceptionally good for so brilliant colored a bird. In quality and form it suggests the Robin, but is less evenly rhythmic, the phrases usually connected without the pauses that characterize the Robin's song. When pauses do occur they are few, and placed at irregular intervals. A high-pitched, rather squeaky call note, "kink," is also characteristic of this bird.

The nest is placed in a bush, usually from six to twelve feet or more from the ground. It is made of fine twigs or stems, often the curving stems of vines, but is so thin-walled that the contents may usually be seen from below. The eggs are bluish, with reddish brown spots. The male bird, in spite of his bright coloring, assists in the duties of incubation.

REDSTART. *Setophaga ruticilla* (Linn.)

Among the warblers, the Redstart is second only to the Blackburnian in brilliance of coloring. The upper parts, throat and upper breast of the male are black, enlivened by patches of brilliant, fiery orange on the wings, tail and sides of the breast. The under parts are white. The female is soft brown where the male is black, and yellow where he is orange, a more modest coloring than that of her mate, but by no means unattractive. Young males are brown and yellow like the female, but with breast patches beginning to show traces of orange. As they wear this plumage until a year or more old, birds of this sort may often be found singing and sometimes mated and nesting.

This warbler does not seem to be especially common in the Park. It inhabits low growths of thick bushes or small trees, in places where small flying insects, which form a large part of its food, abound. It is an active little bird, flitting about through the bushes, darting out for tiny insects, or spreading its tail in a way that seems designed to show its beautiful markings.

The song is weak, and delivered in a high-pitched, thin voice. It is quite variable in form, "tsee tsee tsee tsee-eet," with an upward slur on the last note being a common form. The bird often indulges the habit of singing two or three entirely different songs, one after the other. The quality of voice will distinguish it better than the form of the song.

The nest is placed in a bush or small tree, usually six to ten feet from the ground. It is similar to those of other warblers. The female incubates the eggs, but when they are hatched both parents take part in feeding the young.

MOURNING DOVE. *Zenaidura macroura carolinensis* (Linn.)

This bird may be identified by its rather large size, a little larger than the Robin, its long tail, with middle feathers longest and outer feathers marked with white, its rather pointed but not narrow wings, and general blue-gray color. Its swift flight, when once known, is also characteristic.

This wild Dove is uncommon in the Park, but mainly found in the trees and bushes bordering streams. It was seen along the Allegheny River, near Salamanca July 3, in the Tunungwant Valley July 23, and near Limestone Brook the same day, where a pair were found feeding on the ground in an open field. One was also heard along Quaker Run on July 9. The birds are most likely to be seen in pairs through the summer.

The voice of this bird is unmistakable. It is a long-drawn-out, slow, mournful cooing, lower-pitched than most bird notes, usually beginning with a higher-pitched note, slurring first upward and then downward, and ending with three or four notes low in pitch and slurred downward. It may be written "ooee-eeah-coo-oo-coo-coo-oo."

The nest of this bird is a flat platform of sticks placed in a bush or tree, sometimes one that overhangs water. Only two eggs are laid, and these are pure white.

TREE SWALLOW. *Iridoprocne bicolor* (Vieill.)

Adults of this bird are easily distinguished by the pure white, unmarked under parts, and the light bluish green or greenish blue upper parts. While most books list this species as a green bird, many individuals are more blue than green and some even a pronounced violet. Young birds are plain brownish gray above and white beneath. They might be mistaken for Rough-winged or Bank Swallows, but the white throat will distinguish them from the first, the lack of a continuous brown chest band from the second, and the grayer back from both.

The Tree Swallow is probably not a nesting bird in the Park, and will not be found all summer. Birds begin wandering southward from their nesting grounds in July and increase in numbers until August. The first bird of this species was seen in the Cold Spring Valley, July 15, and more were seen later at various points. In late summer their number would probably be greatly increased. They live in the open, particularly near water, and perch on wires or the tops of dead trees.

The notes of this Swallow are twitters similar to those of other Swallows, but at times, particularly in the nesting season, the voice is sweeter and more musical than that of any other American Swallow except the Purple Martin.

While they probably do not nest in the Park, it is barely possible that they do. The nest is placed in a hole in a tree or dead stump, or sometimes in a crevice of a building or a bird house. They prefer the edges of lakes or the vicinity of water for nesting. The formation of artificial lakes in the Park and the erection of bird houses near their shores might encourage this species to nest here.

NORTHERN WATER-THRUSH. *Seiurus noveboracensis noveboracensis* (Gmel.)

This bird is quite similar to the Louisiana Water-Thrush, from which it is distinguished by the more yellowish shade of the under parts and of the line over the eye, as well as by the heavier spotting of the breast and particularly the throat.

This is one of the rarer birds of the Park. I met with but a single male bird, first found by hearing the song and tracing it to its source. It was noted singing in the same spot, on Quaker Run near Frecks, for several days early in July and again on August 4. It lives along brooks and streams where willows are dense, and in a somewhat more swampy location than that chosen by the Louisiana Water-Thrush.

While the plumages of the two water-thrushes are much alike, the songs are easily distinguished. That of the northern bird is lower in pitch and faster in time than the Louisiana's. It is more emphatic, but less sweet in quality. In fact, the whole song bears a strong resemblance to the ending of the Louisiana's song; and when both these songs, and the flight song of the Oven-bird are known, a distinct relationship will be noted. The song I heard in

the Park may be written as "wit-wit-wit-wit-wit-wit-tititiwit," becoming faster and lower in pitch toward the end. This song was a fair example of the song of the species, though it varies considerably.

The nest of this bird is hidden under a bank of moss or in the roots of a fallen tree. It is made of moss and rootlets.

SPARROW HAWK. *Falco sparverius sparverius* Linn.

This little hawk may be known by its small size, pointed wings, light reddish brown back, and the black marks about its face. The wings of the male are blue-gray, while those of the female are mainly reddish brown. The more pointed wings and different flight distinguish it from the Sharp-shinned Hawk, even when the colors are not easily made out.

The Sparrow Hawk is not common in the Park. One bird was seen in Cain Hollow, a tributary of Quaker Run, July 11, and a pair were seen in the Tunungwant Valley, July 25 and 27. These birds like the open country for their hunting, but must have dead trees or limbs for nesting holes. They find such conditions in the Park more commonly along streams than elsewhere, where all the birds seen were found, but are also likely to be found in orchards and among shade trees, and hunting over open fields.

The voice of this hawk is high and shrill, the commonest call being a series of rapidly repeated notes, written in most books, as "killy killy killy" but, as I usually hear it, only one-syllabled "keh keh keh keh keh."

The nest is in a hole in a dead tree, often one that has been previously used by a Flicker. Such a hole was found in a dead hickory near the place where the pair were noted in the Tunungwant Valley, and was very likely their nesting site, although the birds were not seen to enter it.

LOUISIANA WATER-THRUSH. *Seiurus motacilla* (Vieill.)

This bird, about the size of the English Sparrow, is plain uniform dark brown above with a white line over the eye, the only distinctive marking of the upper parts. The under parts are white, the breast, but not the throat, spotted with dark brown. It is easily distinguished from the Oven-bird by its lack of an orange crown, and separated with more difficulty from the Northern Water-Thrush by the whiter, less yellowish under parts, white eye line and unspotted throat.

This species was found in but one place, and that not within the Park boundary but along the Allegheny River just above Salamanca, where it was noted in song on July 3 and 5. It is probably extremely rare, if it occurs at all within the Park.

It is always found near water, its preferred summer home being the mossy banks and wet stones of a fair-sized brook, where it runs over the ground, flies low over the water, or sits on a wet stone, tilting its tail up and down in a curious manner.

When the bird sings it mounts to the tops of the trees that grow along the stream. The song to my ear has a wild sweetness that

- makes it the most musical of the warbler family. "Teweeet-weet weet-titititup up" are syllables that will represent an average sample. The first three notes are high-pitched, measured, and usually slightly slurred upward, suggesting the song of the Scarlet Tanager, in time and pitch, though much sweeter in quality. The remaining notes are quick, short, abrupt, and falling in pitch.

The nest of this bird is well concealed under a mossy bank of the stream. When the female is incubating it can best be located by stamping along the bank and causing the sitting bird to fly out. When young are being fed it may be found by patient watching of the adult birds.

TENNESSEE WARBLER. *Vermivora peregrina* (Wils.)

This little bird may be known by its olive-green back, gray head and white under parts. It should not be confused with the Red-eyed or Warbling Vireos from both of which it can be distinguished by the lighter gray head and sharper bill, and from the Red-eye by smaller size. The lack of a mark in the wing distinguishes it from the female of the Black-throated Blue Warbler.

The Tennessee Warbler is rare in the Park, and it is doubtful if it breeds there. My only record is that of a single individual seen in shrubbery along the roadside near Frecks on August 7. The bird was close to me and low down, giving me a satisfactory view of all its marks. From descriptions of its home by other observers it is evidently an inhabitant of dense thickets along stream valleys, so I have included it here. The bird seen was probably an early fall migrant. In migration it occurs in the tops of trees as often as in low bushes.

The Tennessee Warbler's song is loud and high-pitched, but not musical. It may be written "pita pita pita pita-wit wit wit wit-zi zi zi zi zi zi zi zi zi." It is usually in three parts as this suggests, but is sometimes in only two parts. Each part is generally a little higher in pitch and a little louder than the preceding one.

CERULEAN WARBLER. *Dendroica cerulea* (Wils.)

The Cerulean Warbler, like most of its family, is smaller than the English Sparrow. The male has the upper parts light cerulean blue, striped with black, with white wing bars and tail patches. The under parts are white with a band of black across the breast. The female is grayer above, without black stripes, and her breast is yellowish white without the black band. The white wing bars are prominent.

• The Cerulean Warbler is one of the rare birds of the Park, only a single bird having been seen. While it occurs regularly in western New York it is extremely local and confined mostly to lowland regions, where it lives in the tops of tall hardwood trees. On July 21, I found this bird in the top of a tall maple on Quaker Run. I discovered it through hearing the song, which sounded vaguely familiar, although I was unable to determine the species by this alone, as it was thirteen years since I had last heard it. The song

as I wrote it down was "cree-cree-cree-cree-cree-e-e-tup." The first four notes are of even pitch, the fifth a tone higher, and the last note drops sharply. Whether this is a typical song for the species I cannot yet say. The voice was quite loud, but not particularly musical. The ending suggested the Parula Warbler, but the voice was somewhat like that of the Black-throated Blue, while the rhythm—the fifth "cree" being twice the length of each of the other four—was as perfect as that which characterizes the Nashville Warbler. I watched the tree for about half an hour, before the little bird finally came out of the dense foliage where I could get a brief, but thoroughly satisfactory view of its beautiful colors.

Whether the bird nests in the Park may well be questioned. Perhaps my single specimen was but a wanderer from a distance. Many times in July I passed the point where it was found, but did not find it or hear it again.

IDENTIFYING BIRDS IN THE FIELD

The student of birds, who is just beginning the fascinating study, often wishes for the companionship in the field of one who is already well initiated. He hopes that such companionship will help him to find and know the birds more easily. Yet when the opportunity comes he is often disappointed. The expert identifies birds about him so quickly and unerringly by a mere glance, a flash of a wing, a bit of song, that the beginner feels lost and gains less from his opportunity than he expected.

There is no short or easy method of obtaining a knowledge of birds. It must all come by slow, careful, painstaking work, whenever the opportunity arrives. Above all, one should observe quietly, avoiding quick motions and keeping all the senses alert (figure 94). Once the student gets a fairly intimate acquaintance with our commoner birds in the field, he too learns to distinguish them at a glance; and many little points of flight or habit or voice that are impossible to describe in a book are stored up in memory. Just as one knows his friends at a long distance by the way they walk, so he knows each kind of bird by its pose and manner of flight. Just as he knows the voices of his friends over the telephone, so he recognizes the bird songs of woods and fields. That he senses the sights and sounds of the forest and the ways of wild life with increasing accuracy, he does not himself doubt. But it is difficult for him to explain just how he does it. Only long, patient observation and practice sharpen one's perception and disclose the deeper secrets of the woods.

Most of the popular bird guides emphasize the color of birds, as a means of identification. Color is perhaps the first, and most important factor, at least for the beginner, but it is by no means the only one. The observer soon finds that size, shape, habit, flight, voice and association all have their importance and each one may be of great value in naming a bird in the field.

Identification by Color. The successful student of birds must have a reasonably good knowledge of color and color names. If his sense of color is not good he is handicapped at the very beginning. The identification of some of the more difficult species, when color alone is considered, often hangs upon a slight distinction difficult to perceive in the field. Thrushes, flycatchers and sparrows are often to be distinguished by slight differences in shades of olive, brown, gray, buff or cream. These colors, however distinct when on paper close to the eye, are most difficult to distinguish when on the feathers of a live bird flitting through the dim light of a forest and concealing itself in the foliage.

To see color clearly the light must be in the right direction, coming from back of the observer and not from behind the bird. A bird seen against the skyline will appear all black, when in reality it may be brightly colored. Iridescent plumage, as that of the swallows, the Hummingbird, and the blackbirds is liable to appear any color but the right one. The observer must then maneuver to get his bird in the proper light, and if possible against a dark background, such as the foliage or trunk of a tree or the ground itself. If, while attempting to do this, the bird disappears into places where it cannot be found or followed, the observer must patiently put off its identification to a more opportune time, storing up in memory or his notebook the observations already made, for future reference.

Identification by Size. Most beginners underestimate the size of a bird in the field. For this reason size expressed in length by inches is deceiving. Ask anyone who has never looked it up in a book how long a Robin is, and he will be likely to say six or seven inches. In reality the length is nearly ten inches. For this reason, expressions such as "a little smaller than the Robin" or "a little larger than the English Sparrow" mean more to the beginner than length expressed in inches. I have used such expressions here in describing the Allegany Park birds, comparing their sizes with three well-known birds, the English Sparrow, Robin and Crow, whose lengths are approximately six, ten and eighteen inches.

The length of a bird is not always a true measure of its size or weight. For example, the Brown Thrasher is considerably longer than the Meadowlark; but the Meadowlark is really a larger and heavier bird, with a short tail, whereas the Thrasher appears more slender, with a long tail. Long-winged birds in flight often appear larger than they really are. The Osprey has often been mistaken for an Eagle, not so much because of the white on its head, as because of the long wings that make it appear unusually large.

Estimate of size is frequently difficult to make in the field, and identification of a bird by size alone is never safe. One cannot distinguish with certainty in the field between Herring and Ring-billed Gulls, or Common and Fish Crows by size alone. Even a trained observer often has the experience of seeing a bird that appears much larger or smaller than the species to which he knows it belongs. It is really not so much larger or smaller, for the size

of the individual of a species varies only slightly. When one has just been looking at a small bird, a large bird appears larger than normal and vice versa. The distance of the bird from the observer is often underestimated, also. Size is nevertheless an important factor, and the beginner should always note his impression of the size of a bird he wishes to identify, comparing it if possible to birds that may be near it and with which he is well acquainted.

Identification by Shape. Birds as a group show little variation in the shape of their bodies. Since they are built for flight, shape must necessarily be about the same in all species. The principal shape characters are to be found in length or contour of wing or tail, shape of the bill, length of neck or legs and presence or absence of a crest on the head. In some species these are an almost absolute means of identification, determining the resting pose or manner of flight, distinguishable at considerable distances. A Kingfisher might be identified by the shape of its head alone without a single color character. The deep fork of the Barn Swallow's tail separates it at once from any other Swallow. The tail of the Grackle, the bill of the Grosbeak, the legs and neck of the heron are all examples of shape characters that are extremely useful as means of identification. The shape of the bill at once indicates whether a small bird is to be looked for among sparrows and finches, or warblers, vireos or thrushes.

Identification by Habit. Habits of birds, once learned, are extremely useful in identification. Such habits may be flight, methods of feeding, whether flocking or solitary, manner of perching, walking or hopping. The bird sitting alone in the top of a dead tree might be a Kingbird, a Bluebird or a Shrike. It could hardly be a warbler or a vireo. But the bird that flits incessantly about among the foliage, giving the observer scarcely a glimpse of its plumage, is very likely warbler or vireo. Those birds feeding in a flock in the meadow might be Meadowlarks, Cowbirds, Starlings or Grackles, but they would certainly not be wrens or warblers or chickadees. The flights of swifts and swallows are instantly distinct to one who knows these birds although the difference may be difficult to describe. The habit of slowly lifting and lowering the tail on the part of the Hermit Thrush will separate it from other Thrushes almost as certainly as the color. When a little bird climbing on a tree trunk turns and runs head downward, we know it cannot be a woodpecker, but is either a nuthatch or Black and White Warbler.

Identification by Associations. Birds, with their power of flight, are more difficult to relegate to any one kind of habitat or locality than are most forms of wild life. It is always possible for a bird to be out of its natural environment. Yet birds have decided preferences as to their associations, and these preferences are great helps in identification. We do not expect to find the Bluebird, Grackle, or Kingbird in a dense forest; nor the Oven-bird, vireo or warbler in an open meadow. The Field Sparrow, Towhee and

Yellow-throat suggest low thick bushes; the Kingfishers, Sandpipers, Green Heron or Red-winged Blackbird, presence of marsh, pond or stream. The student who relates birds to their environment will find that the knowledge he gains by so doing will be his greatest help in intuitive field identification.

Identification of Voice. All the other means just discussed by which we can identify birds have depended on seeing the bird. But the ear can be trained to distinguish birds quite as well as the eye. Songs are difficult to describe with exactness, yet there is in the song of each species something characteristic, something specific, that distinguishes it at once from all other species. We can see a bird well enough to determine its colors accurately only at a comparatively short distance, only on the side from which the light comes, and only when no leaves, branches or other obstructions are between us and the bird. But we can hear it as far as its voice carries, and from any direction.

Song cannot be used as an absolute identification in all cases, for it is too variable a factor. While a large percentage of birds of a given species may sing in a perfectly characteristic manner, occasionally one may have a freak song, sufficiently lacking in the characteristics of its species to make its identity doubtful until it is actually seen. Even the best observer, one who can identify instantly each species of thrush, vireo or warbler by its voice alone, hears now and then a song that puzzles him. The bird in such cases must be identified by sight.

In regions where the Starling is abundant, one must be careful in making identifications by song, for the Starling has become a clever mimic of many American birds. The Catbird and Thrasher likewise often imitate other birds, but their imitations are usually interpolated in the midst of their own characteristic songs, so they need not deceive one. But the Starling imitates Wood Pewees, Cowbirds, Chickadees, Grackles and other species so perfectly that the observer must be always on the alert.

A question that will come to the observer is this, "Shall I keep records of the birds I have heard only, as well as those I have seen?" The answer to this depends upon circumstances. The carol of the Robin, the long call of the Flicker, the peculiar trill of the Field Sparrow and even many of the more difficult warbler songs, are unmistakable when sung in the normal, characteristic manner of the species. If the song heard is perfectly characteristic, if the observer is sure he knows that song beyond question, and if there is nothing unusual in season or locality about the record, then it is just as good as actually seeing the bird. But if there is the least question on any of these points, one should otherwise verify his observation, or failing in this, should record it as doubtful.

On the third of July, my first day in this region, as I walked along the river below Salamanca, I heard a bird sing once. Instantly I thought to myself: "Orchard Oriole." Then I listened again, but the bird had evidently sung all that it was going to. Where to go and look for it I could not be sure. This bird is of

rare occurrence in the Allegany Park country, and although my identification may have been entirely right, I have left the bird out of my list.

On the same day I heard my first Red-eyed Vireo in that region. There were several birds, and they sang persistently. The song was entirely characteristic of the species, and I knew it well. Therefore I did not hesitate to include this bird in my list immediately, although it was more than a week before I actually saw one.

He who would use song as a means of identifying birds must possess an ear for music. If his sense of music is lacking then he will have difficulty in remembering bird songs. Five factors are present in bird songs, and the variations in these factors are the points that distinguish different songs from one another. These factors are pitch, time, quality, intensity and pronunciation. Pitch may vary from the extremely high-pitched songs of some warblers to the low-pitched "coo" of the Mourning Dove. Songs may have little or no pitch variation, as in the Junco, or extreme variation as in the Bobolink and Brown Thrasher. In time, songs vary from short performances scarcely more than a second in length to long-continued songs that may last fifteen minutes. The time may be regularly or irregularly rhythmic or entirely lacking in rhythm. In quality, songs may vary from sweet, clear and highly musical ones to harsh phrases that jar and grate upon the ear. The intensity or loudness of song varies greatly. Sometimes there is a distinct variation in the loudness of certain single notes. Some birds have marked consonant sounds in their songs. Liquid sounds like the letter l, are common in the best singers, while explosive consonant sounds like the letters t, d, p, are characteristic of others. The beginner will find that writing the syllables as they sound to him will be more helpful than trying to fit English words or phrases to a song. The latter may be useful to some extent in indicating the rhythm, but they seldom fit the bird's pronunciation perfectly.

FIELD KEY TO THE BIRDS OF ALLEGANY PARK

How to use the Field Key. The following key for the identification of birds, is designed for the use of the field student. Descriptions are purposely not complete in many details, but are confined to those points easily observed in the open. The key includes plumages of females and young where they differ from those of adult males.

In many cases the same species has been included under several different color headings, because of the fact that under different conditions different colors and marks are more conspicuous. The student must have a good sense of color and a reasonable knowledge of color names. Experience has shown me that many persons are not so equipped. Grays, browns and dull greens are easily confused. Birds of such inconspicuous colors must be carefully observed in good light in order to identify them properly.

The beginner will find that at first he fails to identify many birds because he has not made out such details as wing bars, lines over or through the eye, or spots on throat or breast. To identify birds successfully such detail must be observed, particularly in the brown, green, gray and yellow groups. In dealing with size it must be remembered that mistakes are easily made in the field. The bird that seemed larger than a Robin, if not found under that heading, should be looked for in a larger or smaller group. The first division of the key, between the smaller and the larger birds, has been difficult to apply absolutely. Field estimates of size are at best only rough, and some birds are more likely to be confused with other closely related kinds, or those similar in habit, than with others more nearly of their own size. A few birds not much larger than the Robin are likely to be confused with the birds of the larger group. Thus in constructing the key it has been considered best, in a few exceptional cases, to bring the related or easily confused species together for comparison without strict regard to size. Thus the Screech Owl, Woodcock, Sharp-shinned and Sparrow Hawks will be found classed with the larger birds—larger than the Robin, and the Pileated Woodpecker with the smaller birds—those little larger than the Robin and smaller.

The key has been arranged somewhat differently from those in general use. One should begin with the first number on the left and determine whether the bird belongs in the group of smaller, 1, or larger, 2, birds. The numbers on the right, 3 or 265, tell where to turn next. The great majority of birds seen will belong in the smaller group, 3. Beginning with 3 we find these birds are divided into eight groups according to the *predominant color*, and are numbered from 3 to 10. The numbers in parenthesis on the left indicate the number from which we have come, so that the key may be readily followed backward. Having determined to which color group our bird belongs, we next turn to the number indicated on the right margin of the page and continue from there. If the characteristics following the number do not fit your description of the bird in question, continue with the next consecutive number until one is found that does. The reference following the name of the bird gives the page on which a fuller description, together with notes on habits and voice, will be found.

Let us assume a case to illustrate the method of using the key. We have seen a bird in the field and have a fairly good provisional description of it (cf. p. 298). It was singing in the branches of a tree, a rather musical, long-continued song, made up of short, quick phrases of three or four notes each, with pauses between the phrases. It was olive-green on the upper parts, white beneath, with the top of the head gray, a dark line through the eye, and a lighter line over it. It was no larger than an English Sparrow, and perhaps a little smaller.

It obviously belongs among the smaller birds, and among those *green or greenish* in color. This leads to number 116. Here we read, "Larger than the English Sparrow." This does not agree,

so we turn to 117 which reads, "Size of the English Sparrow or smaller," and this leads to 122. Under 122 we read, "Exceedingly small. Bill long and needle-like." This does not apply so we try 123, "Not exceedingly small. Bill not needle-like," which leads to 124. This reads, "Wing conspicuously long and pointed," which does not fit the case, so we pass to "Wing not conspicuously long and pointed," under 125. This leads to 126 and reads, "With conspicuous wing bars." We did not make out this point, or our notes say nothing about it. So we will assume it had wing bars and try 126 and then if that does not agree we will try 127. From 126 we turn to 128, "Throat black," which is not the case. Then 129, "Throat white," leads to 130. There are two sub-heads, 130 and 131, and the former, 130, reads "Head bluish gray," etc., which agrees with our bird better than 131. But the description in the key does not agree fully, for we did not see a line encircling the eye, nor the yellowish sides, and the key says nothing about a dark line through the eye.

We have come to the end of the birds under 126, "With conspicuous wing bars," so probably our assumption that the bird had wing bars was wrong. So we return to 126 and start with 127, "Without conspicuous wing bars," which leads to 132. Here we read, "Top of the head gray in contrast to the olive-green back. A white line over the eye and a darker line through it." This fits our bird perfectly, so we pass to 134. Under 134 and 135 we find two birds, the Red-eyed Vireo and the Tennessee Warbler, both of which descriptions might fit our bird. We do not feel sure about the slight differences in size, slenderness of bill or brightness of coloring. Let us see what the text has to say about these birds, as indicated by the references to pp. 298, 329.

In the text we find that the Red-eyed Vireo is exceedingly common in the Park, while the Tennessee Warbler is rare. The description of the song of the Red-eyed Vireo agrees with the one we have heard, while that of the Tennessee Warbler does not. We conclude, therefore, that our bird is probably a Red-eyed Vireo, and our acquaintance with one of the common and characteristic birds of the Park has begun.

In the above case we assumed that the bird in question was seen quite clearly, as to most details, and the colors clearly made out. When such is not the case it will not always be possible to use the key, and the bird is better left unidentified for the present. If a bird has been clearly seen, and yet cannot be traced in the key, the student should consult some good general handbook of birds, for other species than those listed probably occur in the Park.

Key for the Identification of Birds in the Field

- 1 Smaller birds, from a little larger than the Robin, downwards... 3
 2 Larger birds, larger than the Robin..... 265
 3 (1). Birds mainly brown or brownish in color..... 11
 4 (1). Birds mainly gray or grayish in color..... 89
 5 (1). Birds mainly green or greenish in color..... 116
 6 (1). Birds mainly black in color..... 138
 7 (1). Birds mainly black and white in color..... 143
 8 (1). Birds mainly blue or bluish in color..... 174
 9 (1). Birds mainly yellow, or orange, or marked with yellow or orange. 191
 10 (1). Birds mainly red, or marked with red, or brownish red..... 238
 11 (3). Larger than the Robin..... 14
 12 (3). Smaller than the Robin, but larger than the English Sparrow... 24
 13 (3). Size of the English Sparrow or smaller..... 48
 14 (11). Wings conspicuously long and pointed..... 16
 15 (11). Wings not conspicuously long and pointed..... 18
 16 (14). Back mottled. Tail and throat marked with white or buff.
 Usually seen on the ground or in low limbs of trees in the woods.
 Head large, but bill small..... **Whip-poor-will**, p. 289
 17 (14). Back plain brown. Lower back reddish brown. A white ring
 around the neck. Lower parts pure white, crossed on the
 throat and breast by two black bands..... **Killdeer**, p. 314
 18 (15). Upper parts uniform plain brown. Tail long and marked with
 white. Under parts pure white, unmarked..... 22
 19 (15). Upper parts bright reddish brown. Tail long. Under parts
 white, heavily streaked with brown..... **Brown Thrasher**, p. 280
 20 (15). Upper parts brown, barred with black. Lower back white,
 conspicuous in flight. Under parts buff, spotted with black.
 A black crescent-shaped mark on the front of the breast, and a
 similar shaped mark of red on the back of the head. Male with
 a streak of black on the cheek..... **Flicker**, p. 262
 21] (15). Upper parts brown, streaked. Tail with white outer feathers,
 conspicuous in flight. Under parts rich yellow, with a black
 v-shaped mark across the breast..... **Meadowlark**, p. 273
 22 (18). Bill partly yellow. Wings showing reddish brown in flight.
 Under side of the tail with large white spots. Eyelids not red.
Yellow-billed Cuckoo, p. 324
 23 (18). Bill black. Wings without reddish. Under side of the tail with
 narrow white marks. Eyelids red.... **Black-Billed Cuckoo**, p. 325
 24 (12). Head conspicuously crested..... 26
 25 (12). Head not conspicuously crested..... 28
 26 (24). Crest, wings and tail, tinged with red. Tail blackish. Rest of
 plumage, plain brown..... **Cardinal**, female, p. 281
 27 (24). Crest not red. Tail tipped with yellow. Black about the eyes.
 Plumage soft brown, shading to gray on wings and tail and yel-
 low beneath. With or without red marks in the wings.
Cedar Waxwing, p. 261
 28 (25). Entire plumage plain grayish brown..... 30
 29 (25). Plumage not plain brown, either streaked or lighter below than
 above..... 32
 30 (28). Bill short, tail medium in length..... **Cowbird**, female, p. 274
 31 (28). Bill long, tail short..... **Starling**, young, p. 268
 32 (29). Legs and neck rather long; bill short. Usually seen in marshes
 among cat-tails or tall grass. Upper parts olive-brown streaked
 with white. Lower parts gray with black on the throat.
Sora, p. 312
 33 (29). Legs and neck not long..... 34
 34 (33). Plumage streaked above..... 36
 35 (33). Plumage plain uniform brown above..... 41
 36 (34). Breast conspicuously streaked..... 39
 37 (34). Breast not streaked, but sides lightly streaked. Usually in open
 meadows..... **Bobolink**, female, p. 274

- 38 (34). Breast faintly streaked or with a black patch. Black marks about the head. Back pale brown, streaked. Tail brown on the central feathers, with outer feathers black, edged with white. **Prairie Horned Lark**, p. 276
- 39 (36). Bill broad and heavy. Usually seen in woods and thickets or amid foliage. **Rose-breasted Grosbeak**, female, p. 325
- 40 (36). Bill not especially broad and heavy. Usually seen in open country or about marshes. **Red-winged Blackbird**, female, p. 311
- 41 (35). Marked with conspicuous white on the wings and tail, sides reddish. **Towhee**, female, p. 278
- 42 (35). Marked with white wing bars. Reddish color in the wings and tail, conspicuous in flight. Throat gray, under parts pale yellow. **Crested Flycatcher**, p. 264
- 43 (35). No wing-bars or other white marks. Upper parts plain brown or somewhat reddish brown. Breast spotted. 44
- 44 (43). Upper parts uniform tawny brown. Breast faintly spotted, often appearing unspotted in a faint light. **Veery**, p. 322
- 45 (43). Upper parts olive-brown, distinctly reddish on the head. Breast heavily spotted. **Wood Thrush**, p. 292
- 46 (43). Upper parts olive-brown, distinctly reddish on the tail. Breast medium heavily spotted. **Hermit Thrush**, p. 291
- 47 (43). Upper parts plain olive-brown without reddish anywhere. Breast medium heavily spotted. Cheeks and sometimes the throat distinctly buffy. **Olive-backed Thrush**, p. 293
- 48 (13). Wings conspicuously long and pointed. Usually seen in flight or on conspicuous perches. 50
- 49 (13). Wings not conspicuously long and pointed. Usually seen either on the ground or in trees or bushes. 56
- 50 (48). Lower back with a conspicuous patch of buff or pale brown. **Cliff Swallow**, young, p. 266
- 51 (48). Lower back the same color as the rest of the upper parts. 52
- 52 (51). Tail rounded, under parts nearly as dark as upper. **Chimney Swift**, p. 267
- 53 (51). Tail forked. Under parts distinctly lighter than upper. 54
- 54 (53). Throat white, breast crossed by a brown band. **Bank Swallow**, p. 315
- 55 (53). Throat gray, breast without brown band. **Rough-winged Swallow**, p. 314
- 56 (49). Very small. Upper parts barred with darker. 58
- 57 (49). Not very small or barred above. 60
- 58 (56). Upper parts rich brown. Under parts only slightly lighter. Tail very short. In deep forests. **Winter Wren**, p. 289
- 59 (56). Upper parts grayish brown. Under parts distinctly lighter. Tail medium short. In orchards and about buildings. **House Wren**, p. 265
- 60 (57). Upper parts uniform brown, not streaked. 62
- 61 (57). Upper parts streaked. 68
- 62 (60). Breast not conspicuously spotted. Grayish brown above, somewhat lighter below. **Indigo Bunting**, female, p. 278
- 63 (60). Breast conspicuously spotted. 64
- 64 (63). Top of the head dull orange, bordered by black lines. Upper parts plain olive-brown. **Oven-bird**, p. 285
- 65 (63). Top of the head the same color as the back. A conspicuous light line over the eye. 66
- 66 (65). Line over the eye and under parts yellowish. Throat and breast heavily spotted. **Northern Water-Thrush**, p. 327
- 67 (65). Line over the eye and under parts nearly white. Breast, but not the throat, spotted. **Louisiana Water-Thrush**, p. 328
- 68 (61). Breast streaked. 70
- 69 (61). Breast not streaked*. 81

*A small brown bird with upper parts streaked and under parts plain white, and a habit of creeping spirally up the rough bark of a tree trunk, is the Brown Creeper, p. 297.

- 70 (68). Outer tail feathers edged with white conspicuous in flight. Shoulders bay color. Usually in open fields or along roadsides. **Vesper Sparrow**, p. 270
- 71 (68). Outer tail feathers not edged with white. 72
- 72 (71). No wing-bars. Breast striped and with a conspicuous dark spot in the center, and a dark stripe on either side of the throat. **Song Sparrow**, p. 319
- 73 (71). With wing-bars. 74
- 74 (73). Smaller than the English Sparrow. 76
- 75 (73). As large as the English Sparrow. 80
- 76 (74). A narrow line through the center of the crown, and a stripe over the eye, which is bright yellow in front. **Savannah Sparrow**, p. 273
- 77 (74). No narrow line through the crown nor bright yellow over the eye. 78
- 78 (77). Crown streaked. **Chipping Sparrow**, young, p. 259
- 79 (77). Crown not streaked. **Field Sparrow**, young, p. 279
- 80 (75). A broad light line over the eye. Bill rather heavy. **Purple Finch**, female or young male, p. 305
- 81 (69). Throat marked with a black patch. Crown gray, sides of the head and shoulders rich brown. **English Sparrow**, male, p. 267
- 82 (69). Throat without black patch. 83
- 83 (82). Breast buffy. Size small, with short tail. **Grasshopper Sparrow**, p. 276
- 84 (82). Breast not buffy, but plain gray. 85
- 85 (84). Larger, upper parts dull grayish brown without reddish anywhere. **English Sparrow**, female, p. 267
- 86 (84). Smaller, upper parts with some distinct reddish brown. 87
- 87 (86). Crown bright reddish brown, bordered by white lines, in contrast to the duller back. Bill and feet black. **Chipping Sparrow**, p. 259
- 88 (86). Crown and back pale reddish brown without contrast. No white crown border. Bill and feet pinkish. **Field Sparrow**, p. 279
- 89 (4). Size of the Robin or larger. 92
- 90 (4). Smaller than the Robin but larger than the English Sparrow. 94
- 91 (4). Size of the English Sparrow or smaller. 103
- 92 (89). Wings long and pointed, marked with conspicuous white patches. Seen mainly in flight toward evening. **Nighthawk**, p. 275
- 93 (89). Wings not conspicuously long and pointed, upper parts gray, speckled with whitish, under parts spotted. **Robin**, young, p. 256
- 94 (90). Body plain gray above and below. Top of the head and tail black. Under tail coverts reddish brown. **Catbird**, p. 321
- 95 (90). Body plain gray above, lighter below. 96
- 96 (95). Under parts pure white, unmarked. A white band across the end of the tail. Head and tail black or blackish. **Kingbird**, p. 256
- 97 (95). Under parts grayish or yellowish white, unmarked. 99
- 98 (95). Under parts spotted. 101
- 99 (97). Legs, neck and bill long. Wing showing a white stripe extending lengthwise when in flight. Usually seen near water on shores of streams or ponds. **Spotted Sandpiper**, young, p. 313
- 100 (97). Legs, neck and bill normal. Upper parts dull gray, darker on the head. **Phoebe**, p. 268
- 101 (98). Legs, neck and bill long. Wing showing a white stripe when in flight. Usually seen near water on shores of streams or ponds. **Spotted Sandpiper**, adult, p. 313
- 102 (98). Legs, neck and bill normal. Upper parts gray with a tint of blue in the wings and tail. **Bluebird**, young, p. 260
- 103 (91). Wings long and pointed. Tail somewhat forked. Seen in flight or on conspicuous perches. Upper parts grayish, under parts pure white. **Tree Swallow**, young, p. 327
- 104 (91). Wings not long and pointed. 105
- 105 (104). Throat and breast dark gray in contrast to white under parts. Outer tail feathers white, conspicuous in flight. Upper parts uniform gray. **Junco**, p. 285
- 106 (104). Throat and breast not gray or else no contrast between these and the under parts. 107

- 107 (106). Throat marked with a black patch. Top of the head black. Back gray. Cheeks white. **Chickadee**, p. 291
- 108 (106). Throat white or whitish. 109
- 109 (108). Upper parts dull gray, not bluish. Wing-bars. Birds usually seen sitting on conspicuous perches or flying out for winged insects. 114
- 110 (108). Upper parts dull bluish gray. Under parts yellowish white. Conspicuous white wing-bars. **Cerulean Warbler**, female, p. 329
- 111 (108). Upper parts light bluish gray. Under parts and cheeks white. Top of the head black or dark gray. Usually seen climbing on large limbs, often head downward. **White-breasted Nuthatch**, p. 295
- 112 (108). Head only bluish gray. Back olive-green. Under parts white with yellowish sides. A white mark extending from the bill to the eye and encircling the latter. Wing-bars. **Blue-headed Vireo**, p. 305
- 113 (108). Upper parts dull olive-gray. Under parts yellowish white. A light-colored line over the eye. No wing-bars. **Warbling Vireo**, p. 263
- 114 (109). Larger, wing proportionately longer. Note a long-drawn-out, plaintive "pee-a-wee," **Wood Pewee**, p. 304
- 115 (109). Smaller, wing proportionately shorter. Note a short, quick "chebec" often rapidly repeated. **Least Flycatcher**, p. 263
- 116 (5). Larger than the English Sparrow. 118
- 117 (5). Size of the English Sparrow, or smaller. 122
- 118 (116). Upper parts plain dull green. Under parts yellowish, unmarked. 120
- 119 (116). Upper parts faintly barred. Under parts yellowish white and streaked. **Scarlet Tanager**, young, p. 299
- 120 (118). Wings and tail black. **Scarlet Tanager**, male in late summer, p. 299
- 121 (118). Wings and tail greenish. **Scarlet Tanager**, female, p. 299
- 122 (117). Exceedingly small. Bill long and needle-like. Flight, quick and darting, the bird sometimes poising in air with wings moving so rapidly as to be invisible, but producing a humming noise. Throat red in male and white in female. **Ruby-throated Hummingbird**, p. 323
- 123 (117). Not exceedingly small. Bill not needle-like. Flight normal. 124
- 124 (123). Wing conspicuously long and pointed. Usually seen in flight or on conspicuous perches. Upper parts green or bluish green. Under parts pure white. **Tree Swallow**, p. 327
- 125 (123). Wing not conspicuously long and pointed. 126
- 126 (125). With conspicuous wing-bars. 128
- 127 (125). Without conspicuous wing-bars. 132
- 128 (126). Throat black. Sides of the head marked with yellow. Under parts white. Back green. **Black-throated Green Warbler**, p. 299
- 129 (126). Throat white. 130
- 130 (129). Head bluish gray, with a white mark extending from the bill to the eye, and encircling the eye. Sides yellowish. Back and wings olive-green. **Blue-headed Vireo**, p. 305
- 131 (129). Top of the head and back yellowish green. Cheeks white. **Chestnut-sided Warbler**, young, p. 279
- 132 (127). Top of the head gray in contrast to the olive-green back. A white line over the eye and a darker line through it. 134
- 133 (127). Top of the head grayish green without contrast to the back. 136
- 134 (132). Size of the English Sparrow. Bill rather heavy and blunt. Crown dull gray and back dark olive-green. **Red-eyed Vireo**, p. 298
- 135 (132). Smaller than the English Sparrow. Bill slender. Crown light gray and back light olive-green. **Tennessee Warbler**, male, p. 329
- 136 (133). Upper parts grayish green. Under parts only slightly yellowish on the sides. **Warbling Vireo**, p. 263
- 137 (133). Upper parts olive-green, under parts entirely yellowish. **Tennessee Warbler**, female, p. 329
- 138 (6). Larger than the Robin. Tail long, with the longest feathers in the center. Plumage with purple, green and bronze reflections. **Bronzed Grackle**, p. 261

- 139 (6). Smaller than the Robin. 140
- 140 (139). Plumage entirely black, or speckled more or less with buff. Tail short, bill long and yellow. **Starling**, adult, p. 268
- 141 (139). Plumage black except head, which is brownish. Tail medium length. Bill short and black. **Cowbird**, male, p. 274
- 142 (139). Plumage black except shoulders which are brilliant red, edged with yellow. Tail medium length. **Red-winged Blackbird**, male, p. 311
- 143 (7). Woodpeckers, usually seen clinging to trunks of trees or large limbs in an upright position, never with the head down. 145
- 144 (7). Not woodpeckers. If seen climbing on trunks of trees, then often with the head downward. 163
- 145 (143). Much larger than the Robin. Head crested and marked with red. **Pileated Woodpecker**, p. 297
- 146 (143). No larger than the Robin. Head not crested. 148
- 147 (143). Smaller than the Robin. 154
- 148 (146). Head entirely red. Body and wings marked in large patches of black and white. **Red-headed Woodpecker**, adult, p. 264
- 149 (146). Head with a single spot of red on the back. Back continuous white. Wings black, spotted with white. **Hairy Woodpecker**, male, p. 295
- 150 (146). Forehead dull orange-red. Back continuous white. Wings black spotted with white. **Hairy Woodpecker**, young male, p. 295
- 151 (146). Head without any red. 152
- 152 (151). Wings with large patches of white. Head brownish. Back grayish barred with black. **Red-headed Woodpecker**, young, p. 264
- 153 (151). Wings black with small spots of white. Back continuous white. **Hairy Woodpecker**, female, p. 295
- 154 (147). Red of the head on the forehead. 157
- 155 (147). Red of the head a single spot on the back of the head. Wings spotted black and white. Back continuous white. **Downy Woodpecker**, male, p. 262
- 156 (147). No red on the head. 161
- 157 (154). Forehead and throat red. Back barred. A large white patch in the wing visible when the wing is folded. **Sapsucker**, male, p. 296
- 158 (154). Forehead red, but throat white. 159
- 159 (158). Back barred, and a white patch on the wing. **Sapsucker**, female, p. 296
- 160 (158). Back continuous white. Forehead dull red or orange. Wing spotted, but not patched with white. **Downy Woodpecker**, young male, p. 262
- 161 (156). Back barred and white patch on the wing. **Sapsucker**, young, p. 296
- 162 (156). Back continuous white. Wing spotted black and white. **Downy Woodpecker**, female, p. 262
- 163 (144). Larger than the English Sparrow. 165
- 164 (144). Size of the English Sparrow or smaller. 170
- 165 (163). Under parts entirely black. Upper parts black with large patch of white and buff. **Bobolink**, male, p. 274
- 166 (163). Throat and upper breast black. Upper parts black and white. Under parts white, marked with red or pink. 168
- 167 (163). Entire under parts white. Upper parts apparently black, but actually dark gray, becoming blacker on the head and tail. Tail tipped with a broad band of white. **Kingbird**, p. 256
- 168 (166). Breast marked with a shield-shaped patch of rose or pink. **Rose-breasted Grosbeak**, male, p. 325
- 169 (166). Breast white, but sides brownish red. **Towhee**, male, p. 278
- 170 (164). Top of the head entirely black and not striped. Back gray. 172
- 171 (164). Top of the head striped black and white. Back and wings mixed black and white. Under parts white, with black stripes on the sides, and in the male on the throat. **Black and White Warbler**, p. 296
- 172 (170). Throat with a black patch. Cheeks white. **Chickadee**, p. 291
- 173 (170). Throat and cheeks white. Usually seen climbing on trunks of trees, often head downward, not bracing with the tail. **White-breasted Nuthatch**, p. 295

- 174 (8). Larger than the Robin. Head crested. 176
- 175 (8). Smaller than the Robin. Head not crested. 178
- 176 (174). Crest single and regular. Head normal size. Upper parts bright blue, with wings and tail marked with white and barred with black. Under parts white or grayish, with a black band across the breast. **Blue Jay**, p. 303
- 177 (174). Crest double and irregular. Head and bill large. Upper parts grayish blue. A white collar about the neck and a blue band across the breast. Female with more or less rufous on the sides and breast. **Kingfisher**, p. 313
- 178 (175). Larger than the English Sparrow. Upper parts brilliant blue in the male or grayish blue in female or young. Breast reddish in adults and spotted in young. **Bluebird**, p. 260
- 179 (175). Smaller than the English Sparrow. 180
- 180 (179). Wings long and pointed. Seen commonly in flight or on conspicuous perches in the open. 182
- 181 (179). Wings not conspicuously long and pointed. Seen mainly in foliage of bushes or trees. 186
- 182 (180). Tail deeply forked. Upper parts dark steel-blue with white marks in the tail. Under parts buffy or reddish. **Barn Swallow**, p. 266
- 183 (180). Tail forked but not deeply. 184
- 184 (183). Upper parts dark blue. Lower back with a patch of orange-buff. Forehead with a crescent-shaped white mark. **Cliff Swallow**, p. 266
- 185 (183). Upper parts light greenish blue. Under parts pure white. **Tree Swallow**, p. 327
- 186 (181). Body entirely blue, blackish on wings and tail, and darker on the head. No white in the wing. **Indigo Bunting**, male, p. 278
- 187 (181). Body not entirely blue, and marked with white on the wing. 188
- 188 (187). Throat black. A small white spot in the wing. Under parts white. **Black-throated Blue Warbler**, male, p. 290
- 189 (187). Throat yellow, sometimes crossed by bands of rufous or blackish. Upper parts light blue. Wing-bars white. Center of the back dull yellow. **Parula Warbler**, p. 306
- 190 (187). Throat white, and breast crossed by a black band. Upper parts light blue streaked with black. White wing-bars. **Cerulean Warbler**, male, p. 329
- 191 (9). Larger than the Robin. 194
- 192 (9). Smaller than the Robin, but larger than the English Sparrow. 196
- 193 (9). Size of the English Sparrow or smaller. 206
- 194 (191). Yellow on the breast, which is marked by a black v-shaped mark. Back brown and striped. Outer tail feathers white. **Meadowlark**, p. 273
- 195 (191). Yellow in the linings of wings and tail, conspicuous in flight. Back brown with a white patch on the back. **Flicker**, p. 262
- 196 (192). Throat black. Head and upper back black. Breast, lower back and shoulders bright orange. **Baltimore Oriole**, male, p. 260
- 197 (192). Throat and head brownish black. Breast, lower back and shoulders dull orange. **Baltimore Oriole**, female, p. 260
- 198 (192). Throat gray. Breast pale yellow. Upper parts brown with white wing-bars. Reddish in the wing and tail conspicuous in flight. **Crested Flycatcher**, p. 264
- 199 (192). Throat yellow. 200
- 200 (199). Throat and breast deep rich yellow. Upper parts olive-green. A white line over the eye. **Yellow-breasted Chat**, p. 281
- 201 (199). Throat and breast pale or dull yellow. 202
- 202 (201). Upper parts dull green. 204
- 203 (201). Upper parts streaked with buff, brown and black. Breast buffy yellow with black streaks on the sides. **Bobolink**, in late summer, p. 274
- 204 (202). Wings and tail green. **Scarlet Tanager**, female, p. 299
- 205 (202). Wings and tail black. **Scarlet Tanager**, male in late summer, p. 299
- 206 (193). Entire body mainly yellow. 208

- 207 (193). Entire body not yellow. 210
- 208 (206). Wings and tail yellow or dusky yellow. Breast, in the male streaked with brownish red. **Yellow Warbler**, p. 321
- 209 (206). Wings and tail and a patch on the forehead black. Wings barred with white. **Goldfinch**, male, p. 259
- 210 (207). Yellow mainly on the breast, throat or under parts. 213
- 211 (207). Yellow mainly on the head. 234
- 212 (207). Yellow or orange on wings and tail and sides of breast. 236
- 213 (210). Throat yellow, unmarked. 217
- 214 (210). Throat black, extending in a patch over the top of the head. Under parts and a patch on the forehead, cheeks and about the eye, yellow. Upper parts olive-green. **Hooded Warbler**, male, p. 292
- 215 (210). Throat and breast yellow or orange, marked with black. 231
- 216 (210). Throat and head gray. Breast and under parts yellow. The line between the gray and yellow on the breast abrupt, and margined with black in the male. Upper parts olive-green. **Mourning Warbler**, p. 280
- 217 (213). Without wing-bars. 219
- 218 (213). With wing-bars. 225
- 219 (217). Forehead black, extending in a mask-like patch about the eyes. Upper parts olive-green. **Maryland Yellow-throat**, male, p. 320
- 220 (217). Forehead and entire upper parts olive-green. 223
- 221 (217). Forehead yellow. Top of the head with more or less black. Upper parts olive-green, under parts yellow. **Hooded Warbler**, female, p. 292
- 222 (217). Forehead and back bluish gray. Under parts yellow. **Canada Warbler**, young, p. 322
- 223 (220). Throat and under tail coverts bright yellow. **Maryland Yellow-throat**, female, p. 320
- 224 (220). Throat and entire under parts dull yellow. **Tennessee Warbler**, female, p. 329
- 225 (218). Upper parts light blue with white wing-bars. Center of the back dull yellow. **Parula Warbler**, female, p. 306
- 226 (218). Upper parts brownish olive, yellowish on the lower back. Wings blackish. **Goldfinch**, female, p. 259
- 227 (218). Upper parts olive-green. 228
- 228 (227). Lower back marked with yellow. Sides with black streaks. **Magnolia Warbler**, young, p. 300
- 229 (227). Lower back greenish, under parts dull yellow. **Pine Warbler**, p. 310
- 230 (227). Lower back slaty gray. Throat bright yellow. Under parts white. **Yellow-throated Vireo**, p. 309
- 231 (215). Black consisting of streaks on the sides of the throat. Throat orange in the male, yellow in the female. Patches of orange or yellow in the crown and cheeks. Upper parts black or gray with yellow streaks on the back and a broad white patch in the wing. **Blackburnian Warbler**, p. 304
- 232 (215). Black consisting of a chain of spots across the lower throat suggesting a necklace. Upper parts blue-gray. **Canada Warbler**, p. 322
- 233 (215). Black consisting of a patch in the center of the breast, with black streaks radiating from this patch along the sides and under parts. Upper parts black and blue-gray. Lower back yellow. White patches over the eye and in the wing and tail. **Magnolia Warbler**, p. 300
- 234 (211). Cheeks and a line over the eye yellow. Throat black. Under parts white. Back greenish with white wing-bars. **Black-throated Green Warbler**, p. 299
- 235 (211). Cheeks white. Yellow on the top of the head. Throat white. Sides with a streak of bright chestnut-brown. **Chestnut-sided Warbler**, p. 279
- 236 (212). Upper parts and throat black. Under parts white. Patches in the wing, tail and sides of the breast bright orange. **Redstart**, male, p. 326

- 237 (212). Upper parts brownish. Under parts white. Patches in the wing, tail and sides of the breast yellow. . . . **Redstart**, female, p. 326
- 238 (10). Body mainly red. 240
- 239 (10). Body not mainly red, but marked with red or reddish brown. . . . 242
- 240 (238). Entire body bright red, including the wings and tail. Head crested. Face marked with black. **Cardinal**, male, p. 281
- 241 (238). Wings and tail black. Rest of body bright red. **Scarlet Tanager**, male, p. 299
- 242 (239). Red mainly on the breast or under parts. 247
- 243 (239). Red mainly on the head. 255
- 244 (239). Red entirely on the shoulders. Rest of the body black. **Red-winged Blackbird**, male, p. 311
- 245 (239). Red or orange mainly in the wings and tail and on the sides of the breast. Upper parts and upper breast and throat black. Under parts white. **Redstart**, male, p. 326
- 246 (239). Red on the throat. Size very small. Bill long and needle-like. Upper parts green. Under parts white. **Ruby-throated Hummingbird**, male, p. 323
- 247 (242). Entire breast, lower back and head pinkish red. Rest of the upper parts, including the wings and tail, brown. **Purple Finch**, male, p. 305
- 248 (242). Entire breast brownish red. 253
- 249 (242). Breast with a shield-shaped patch of rose-red. Upper parts black and white. Throat black and the remainder of the under parts white. **Rose-breasted Grosbeak**, male, p. 325
- 250 (242). Breast, crested head and wings tinged with red. Rest of the plumage brownish, face blackish. **Cardinal**, female, p. 281
- 251 (242). Breast black above and white beneath. Sides brownish red. Upper parts black and white in the male and brown and white in the female. **Towhee**, p. 278
- 252 (242). Throat and breast white, but sides with a stripe of brownish red. Top of the head yellow. Back brownish olive, striped with black. Yellowish white wing-bars. **Chestnut-sided Warbler**, p. 279
- 253 (248). Larger, back gray with head and tail blackish. **Robin**, p. 256
- 254 (248). Smaller, back blue or bluish. **Bluebird**, p. 260
- 255 (243). Entire head red. Rest of the plumage black and white in large patches. **Red-headed Woodpecker**, adult, p. 264
- 256 (243). Forehead red. 259
- 257 (243). Back of the head with a red spot. Rest of the plumage black and white. 263
- 258 (243). Top of the head brownish red bordered by white lines. Back brown, streaked. Under parts grayish white. **Chipping Sparrow**, p. 259
- 259 (256). Forehead bright red. Back barred black and white. Throat red in the male and white in the female. **Sapsucker**, p. 296
- 260 (256). Forehead dull red or orange. Rest of the plumage black and white. 261
- 261 (260). Size of the Robin. **Hairy Woodpecker**, young male, p. 295
- 262 (260). Size of the English Sparrow. **Downy Woodpecker**, young male, p. 262
- 263 (257). Size of the Robin. **Hairy Woodpecker**, adult male, p. 295
- 264 (257). Size of the English Sparrow. **Downy Woodpecker**, adult male, p. 262
- 265 (2). Neck and legs long. Neck drawn up but legs extended when in flight. 268
- 266 (2). Neck rather long, but legs short. Neck usually extended in flight. 272
- 267 (2). Neither neck nor legs conspicuously long. 277
- 268 (265). Larger than the Crow. 269
- 269 (265). A little smaller than the Crow. Back appearing blue or greenish blue, but really green. Neck reddish brown. **Green Heron**, p. 324
- 270 (268). Back and wings bluish gray. Size very large. **Great Blue Heron**, p. 314
- 271 (268). Back and wings brownish, streaked. Size smaller. **Bittern**, p. 311
- 272 (266). General color blackish, with white wing linings. Neck outstretched in flight. **Black Duck**, p. 316

- 273 (266). General color gray. Tail long, with the middle feathers longest. Tail tipped with white. Bill short. Flight sometimes accompanied by a whistling noise. **Mourning Dove**, p. 326
- 274 (266). General color brown, mottled with black. 275
- 275 (274). Larger than the Crow. Bill short. Flight straight, and usually accompanied by a loud whirring noise. **Ruffed Grouse**, p. 286
- 276 (274). Smaller than the Crow. Bill long. Flight erratic, usually accompanied by a whistling noise. **Woodcock**, p. 286
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- 280 (277). Upper parts partly light gray and partly brown. Tail partly black and partly white. Under parts mainly white. **Herring Gull**, immature, p. 315
- 281 (277). Upper parts brown or grayish brown. 284
- 282 (279). Head and tail gray. Lower back marked conspicuously with white. **Marsh Hawk**, adult male, p. 275
- 283 (279). Head and tail white. Wings tipped with black and marked with white spots. **Herring Gull**, adult, p. 315
- 284 (281). Head large. Eyes large and looking forward. Breast barred and streaked with brown. Flight noiseless. **Barred Owl**, p. 309
- 285 (281). Head not unusually large. Eyes not conspicuously looking forward. 286
- 286 (285). Tail and head white. Rest of body blackish brown. Very large. **Bald Eagle**, adult, p. 316
- 287 (285). Tail black or blackish. 290
- 288 (285). Tail reddish brown. Rest of the plumage brown above and usually white more or less spotted with brown below. **Red-tailed Hawk**, adult, p. 306
- 289 (285). Tail plain brown. 292
- 290 (287). Size very large. Entire plumage blackish brown, or with a little white in the breast. **Bald Eagle**, young, p. 316
- 291 (287). Size medium large. Body mainly dull grayish brown, indistinctly streaked. **Herring Gull**, young, p. 315
- 292 (289). Upper parts with a conspicuous white mark on the lower back. **Marsh Hawk**, female or young, p. 275
- 293 (289). Upper parts without white. 294
- 294 (293). Under parts heavily marked with reddish brown. Shoulders reddish brown. **Red-shouldered Hawk**, adult, p. 309
- 295 (293). Under parts white, streaked with brown. Either **Red-shouldered** or **Red-tailed Hawk**, young. These species are practically indistinguishable in the field in young plumage. p. 306
- 296 (278). Head large, with conspicuous ear tufts. Eyes looking forward. Plumage mottled, either gray or reddish brown. **Screech Owl**, p. 264
- 297 (278). Head not conspicuously large. No ear tufts; eyes not looking forward. 298
- 298 (297). Upper parts gray or brown. Under parts lighter, spotted or barred. 300
- 299 (297). Entire plumage black. **Crow**, p. 300
- 300 (298). Wings long and pointed. Back reddish brown. Wings with more or less blue-gray. Side of the head with black marks. **Sparrow Hawk**, p. 328
- 301 (298). Wings broad and rounded. Tail long. Back blue-gray in adult or brown, but not reddish in young. Under parts barred with reddish brown in adult or streaked with brown in young. **Sharp-shinned Hawk**, p. 350

LIST OF BIRDS OBSERVED IN ALLEGANY PARK

1. Herring Gull..... *Larus argentatus* Pont.
2. Black Duck..... *Anas rubripes* Brewst.
3. Bittern *Botaurus lentiginosus* (Montag.)
4. Great Blue Heron... *Ardea herodias herodias* Linn.
5. Green Heron..... *Butorides virescens virescens* (Linn.)
6. Sora *Porzana carolina* (Linn.)
7. Woodcock *Philohela minor* (Gmel.)
8. Spotted Sandpiper... *Actitis macularia* (Linn.)
9. Killdeer *Oxyechus vociferus* (Linn.)
10. Ruffed Grouse..... *Bonasa umbellus* (Linn.)
11. Mourning Dove..... *Zenaidura macroura carolinensis* (Linn.)
12. Marsh Hawk..... *Circus hudsonius* (Linn.)
13. Sharp-shinned Hawk. *Accipiter velox* (Wils.)
14. Red-tailed Hawk.... *Buteo borealis borealis* (Gmel.)
15. Red-shouldered Hawk *Buteo lineatus lineatus* (Gmel.)
16. Bald Eagle..... *Haliaeetus leucocephalus* (Linn.)
17. Sparrow Hawk..... *Falco sparverius sparverius* Linn.
18. Barred Owl..... *Strix varia varia* Barton
19. Screech Owl..... *Otus asio asio* (Linn.)
20. Yellow-billed Cuckoo. *Coccyzus americanus americanus* (Linn.)
21. Black-billed Cuckoo. *Coccyzus erythrophthalmus* (Wils.)
22. Belted Kingfisher.... *Ceryle alcyon alcyon* (Linn.)
23. Hairy Woodpecker.. *Dryobates villosus villosus* (Linn.)
24. Downy Woodpecker. *Dryobates pubescens medianus*
(Swains.)
25. Northern Pileated
Woodpecker *Phlæotomus pileatus abieticola* (Bangs)
26. Yellow-bellied Sap-
sucker *Sphyrapicus varius varius* (Linn.)
27. Red-headed Wood-
pecker *Melanerpes erythrocephalus* (Linn.)
28. Northern Flicker ... *Colaptes auratus luteus* Bangs
29. Whip-poor-will *Antrostomus vociferus vociferus* (Wils.)
30. Nighthawk *Chordeiles virginianus virginianus*
(Gmel.)
31. Chimney Swift..... *Chætura pelagica* (Linn.)
32. Ruby-throated Hum-
mingbird *Archilochus colubris* (Linn.)
33. Kingbird *Tyrannus tyrannus* (Linn.)
34. Crested Flycatcher.. *Myiarchus crinitus* (Linn.)
35. Phæbe *Sayornis phæbe* (Lath.)
36. Wood Pewee..... *Myiochanes virens* (Linn.)
37. Least Flycatcher *Empidonax minimus* (W. M. & S. F.
Baird)
38. Prairie Horned Lark. *Otocoris alpestris praticola* Hensh.
39. Blue Jay..... *Cyanocitta cristata cristata* (Linn.)
40. Crow *Corvus brachyrhynchos brachyrhyn-*
chos Brehm

41. Starling *Sturnus vulgaris* Linn.
42. Bobolink *Dolichonyx oryzivorus* (Linn.)
43. Cowbird *Molothrus ater ater* (Bodd.)
44. Red-winged Black-
bird *Agelaius phœniceus phœniceus* (Linn.)
45. Meadowlark *Sturnella magna magna* (Linn.)
46. Baltimore Oriole.... *Icterus galbula* (Linn.)
47. Bronzed Grackle.... *Quiscalus quiscula æneus* Ridgw.
48. Purple Finch..... *Carpodacus purpureus purpureus*
(Gmel.)
49. Goldfinch *Astragalinus tristis tristis* (Linn.)
50. English Sparrow ... *Passer domesticus* (Linn.)
51. Vesper Sparrow ... *Poæcetes gramineus gramineus* (Gmel.)
52. Savannah Sparrow.. *Passerculus sandwichensis savanna*
(Wils.)
53. Grasshopper Sparrow. *Ammodramus savannarum australis*
Mayn.
54. Chipping Sparrow... *Spizella passerina passerina* (Bech.)
55. Field Sparrow..... *Spizella pusilla pusilla* (Wils.)
56. Slate-colored Junco.. *Junco hyemalis hyemalis* (Linn.)
57. Song Sparrow..... *Melospiza melodia melodia* (Wils.)
58. Towhee *Pipilo erythrophthalmus erythroph-*
thalmus (Linn.)
59. Cardinal *Cardinalis cardinalis cardinalis* (Linn.)
60. Rose-breasted Gros-
beak *Zamelodia ludoviciana* (Linn.)
61. Indigo Bunting *Passerina cyanea* (Linn.)
62. Scarlet Tanager *Piranga erythromelas* Vieill.
63. Cliff Swallow..... *Petrochelidon lunifrons lunifrons* (Say)
64. Barn Swallow..... *Hirundo erythrogastra* Bodd.
65. Tree Swallow..... *Iridoprocne bicolor* (Vieill.)
66. Bank Swallow..... *Riparia riparia* (Linn.)
67. Rough-winged Swal-
low *Stelgidopteryx serripennis* (Aud.)
68. Cedar Waxwing..... *Bombycilla cedrorum* Vieill.
69. Red-eyed Vireo..... *Vireosylva olivacea* (Linn.)
70. Warbling Vireo..... *Vireosylva gilva gilva* (Vieill.)
71. Yellow-throated Vireo *Lanivireo flavifrons* (Vieill.)
72. Blue-headed Vireo... *Lanivireo solitarius solitarius* (Wils.)
73. Black and White
Warbler *Mniotilta varia* (Linn.)
74. Tennessee Warbler .. *Vermivora peregrina* (Wils.)
75. Northern Parula
Warbler *Compsothlypis americana pusilla*
(Wils.)
76. Yellow Warbler..... *Dendroica æstiva æstiva* (Gmel.)
77. Black-throated Blue
Warbler *Dendroica cærulescens cærulescens*
(Gmel.)
78. Magnolia Warbler .. *Dendroica magnolia* (Wils.)

79. Cerulean Warbler... *Dendroica cerulea* (Wils.)
 80. Chestnut-sided Warbler *Dendroica pensylvanica* (Linn.)
 81. Blackburnian Warbler *Dendroica fusca* (Müll.)
 82. Black-throated Green Warbler *Dendroica virens* (Gmel.)
 83. Pine Warbler..... *Dendroica vigorsi* (Aud.)
 84. Oven-bird *Seiurus aurocapillus* (Linn.)
 85. Northern Water-Thrush *Seiurus noveboracensis noveboracensis* (Gmel.)
 86. Louisiana Water-Thrush *Seiurus motacilla* (Vieill.)
 87. Mourning Warbler .. *Oporornis philadelphia* (Wils.)
 88. Maryland Yellow-throat *Geothlypis trichas trichas* (Linn.)
 89. Yellow-breasted Chat. *Icteria virens virens* (Linn.)
 90. Hooded Warbler.... *Wilsonia citrina* (Bodd.)
 91. Canada Warbler *Wilsonia canadensis* (Linn.)
 92. Redstart *Setophaga ruticilla* (Linn.)
 93. Catbird *Dumetella carolinensis* (Linn.)
 94. Brown Thrasher *Toxostoma rufum* (Linn.)
 95. House Wren *Troglodytes aëdon aëdon* Vieill.
 96. Winter Wren *Nannus hiemalis hiemalis* (Vieill.)
 97. Brown Creeper *Certhia familiaris americana* (Bonap.)
 98. White-breasted Nuthatch *Sitta carolinensis carolinensis* Lath.
 99. Chickadee *Penthestes atricapillus atricapillus* (Linn.)
 100. Wood Thrush *Hylocichla mustelina* (Gmel.)
 101. Veery *Hylocichla fuscescens fuscescens* (Steph.)
 102. Olive-backed Thrush. *Hylocichla ustulata swainsoni* (Tschudi)
 103. Hermit Thrush *Hylocichla guttata pallasi* (Cab.)
 104. Robin *Planesticus migratorius migratorius* (Linn.)
 105. Bluebird *Sialia sialis sialis* (Linn.)

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ADDENDUM

SHARP-SHINNED HAWK. *Accipiter velox* (Wils.)

This small hawk may be distinguished from all birds but the Sparrow Hawk by its size. From the latter it may be known by its rounded rather than pointed wings, and in adults by its blue-gray back, and under parts cross-barred with reddish brown. Young birds are more brownish on the back and striped with dull brown beneath. The male is smaller than the female, being often only a little larger than the Robin. This bird may always be best identified by its shape in flight, the combination of rounded wings and long tail distinguishing it at once from hawks of both the *Buteo* and *Falco* groups.

The Sharp-shinned Hawk is not particularly common in the Park. In the summer of 1921 it was seen but once on Quaker Run, but in 1922 it seemed to have increased somewhat in numbers. This hawk is unquestionably a greater destroyer of small birds than any other of our common hawks. It often hunts by hiding in thick shrubbery and waiting until its prey approaches, and then pouncing upon it. Because of the fact that it kills many birds it has been hunted and destroyed unmercifully, particularly during its migrations; and in some regions it has become rare as a breeding bird. Yet it is a wild creature that cannot be blamed because nature gave it the instinct to kill birds for a living. It fills its place in nature, and too great a decrease in its numbers is liable to be followed by serious results.

It nests most commonly in the thick branches of a hemlock, sometimes constructing its own nest, and sometimes using an abandoned one originally built by crows. The eggs are curiously blotched and spotted. This hawk is usually silent when it hunts, but in late summer the calls of the hungry young will often betray the location of the nest.

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PLATE 29. A GROUSE FAMILY IN EARLY SUMMER.
The presence of the male, standing on guard, is only occasional at this time.
The scene is here idealized. Drawn by Edmund J. Sawyer.

THE RUFFED GROUSE, WITH SPECIAL REFERENCE TO ITS DRUMMING

By EDMUND J. SAWYER

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INTRODUCTION

No bird is more typical of our woods than the Ruffed Grouse or "Partridge." Many circumstances combine to make this one of the best known and most interesting of all our birds. Wary and wily, exceedingly swift of wing, fine flavored,—to the hunter he is the king of our game birds. Frequenting the woods along every mountain stream, he is the familiar favorite of the trout fisherman. When the last summer bird has gone this hardy forest denizen still remains in undiminished numbers. When the last leaf has fallen, and when still later the deep snow of the wood shows scarcely a sign of other birds, the fresh trails of the Grouse are still to be found winding among the trees. Here and there you may even find his bed of the night before, out of which he bursts through a foot of snow. As an object for study he has attracted most attention by his wonderful "drumming." Following the regular springtime season of drumming comes the charming family life with all its interest. First we look for the nest with its numerous creamy eggs at the foot of some tree, beside a log or under sheltering brush; then, the downy chicks with their marvelous ability at hiding amid the dead leaves; the devoted mother Grouse with her crafty tactics in leading us away from the precious brood; the dust-baths in sunny spots in the wood; and still, now and then, the alluring rumble of the mystic drum!

THE DRUMMING HABIT OF THE RUFFED GROUSE

Theories as to the Drumming Sound. The early ornithologists, —Audubon, Wilson, Nuttall,— as, indeed, their followers until a recent date, had only their several theories as to just how the drumming sound was produced. One thought the wings beat the bird's sides; another, the breast or, again, that the wings struck together above the back. It is about fifteen years since the publication by the present writer of the first, or one of the first, photographs to appear in print of a Ruffed Grouse in the act of drumming; also a life drawing and a description of the drumming, as seen in the woods (Sawyer, '08). Sepia copies of the drawing were distributed separately. From time to time for the past several years have appeared descriptive articles, illustrated with photographs, on the same subject. I think the most complete series of photographs I have seen in print are those by Vreeland, illustrating "The Drumming of the Ruffed Grouse" (Vreeland, '18). Yet much remains to be said of this phenomenon, owing to a still persisting haze of doubt about it, together with certain widely accepted points of misinformation. Professor Hodge, working with captive Grouse, said the sound was produced by virtue of certain so-called feather-cushions (Hodge, '05, p. 644). As for the latter theory it may be sufficient to note that close examination of a Ruffed Grouse fails to reveal any special development of the body plumage. If it was meant that a certain area of the plumage is merely *acted on* as a sound-producing cushion, yet that would still be mere theory and remain to be demonstrated.

Perhaps the most complete and interesting account we have had is that entitled "Some Notes on the Drumming of the Ruffed Grouse" (Tuttle, '19, '20). Mr. Tuttle relates his many observations at Huron Mountain, Michigan, from April 7 to 13, and at Simsbury, Connecticut, from April 15 to May 21. He illustrates his detailed description of the drumming with an excellent photograph of a drumming Grouse. Discussing the drumming, this observer calls attention to the inflated air sacs of related species and adds—"It does not seem to me at all impossible that the sound-carrying power of the drumming of *Bonasa* may in part be traced to an inflation of the rudimentary sacs which it possesses" ('19, p. 337). However, it is not obvious to the present writer that these rudimentary sacs, located as they are on the neck of the bird, could exert any considerable influence on the drumming sound. The wings, which all observers agree are the main consideration, have no contact with the neck in any part of the drumming. Mr. Tuttle believes the wings do not strike together behind the back of the bird. In this I quite agree with him. Commenting further on this point Mr. Tuttle writes, "Should it be proved that the wings do meet, it would still be difficult to prove that the sound was produced by their contact, rather than by the forward stroke against the air" ('19, p. 335). He is quite correct as regards the difficulty in determining how much of the sound would be attributable to the striking together



Fig. 95. A drumming log. The usual log is an old mossy trunk that lies flat on the ground.



Fig. 96. In drumming, the forceful, sound-producing blow is the *outward and upward* motion of the wings.



Fig. 97. The whirring of the "muffled drum." The picture is from an exposure of about 7 seconds, covering half of a drumming performance, beginning with the first wing-beat.



Fig. 98. A snapshot made between wing-beats early in the drumming. The wings hang limp for an instant before the next upward stroke.

of the wings in the case which he assumes. When, however, he refers to the "*forward* stroke against the air" (the italics are mine) as producing the sound, he falls into a common error. This point in the drumming I was lucky enough to clear up for the first time,—at least to my own satisfaction and as regards my own observations. Satisfied by previous observations that the drumming was mainly accounted for by the wings beating the air, I yet failed to understand how it was that the force of the wing-beats did not raise the bird from the log, since I had observed that he did not and could not grasp so broad a perch with any appreciable clinging power. Two of my blinds in 1921 were so favorably situated that this little mystery was very readily solved.

The Drumming Place. The rostrum and stage setting for so interesting a performance as this deserves at least brief mention. The drummings I have heard or witnessed have been in woods as varied as the usual general haunts of this grouse. Some have been in dry hillside growths of beech and maple, some in cedar thickets; many have been in mixed woods, often of a very swampy character. In other words, it appears that the Ruffed Grouse drums wherever he happens to live. The more exact spot selected may be deep in the wood or, again, may be near its edge; the sort of log preferred seems to be the greater and deciding consideration. I have known grouse to drum directly on the ground, on some bare spot screened by hemlock or other evergreens. Other observers have reported the birds drumming on rail fences and stone walls. Yet the usual drumming place is a log; and the usual log, an old mossy trunk that lies flat on the ground or even half-buried on the forest floor (figures 95, 120). Often it is falling to pieces from decay, with only here and there a spot sufficiently sound to afford the drummer a foothold; seldom is it a trunk recently felled, whether by wind or otherwise. Only in one instance have I seen a Ruffed Grouse use a drumming log which was sound on the outside and quite hollow within. The sound from this log, by the way, was the same dull characteristic "thumm"-ing. Yet, on one popular but mistaken theory (that the bird beats the log with his wings), this log should have proven a particularly resonant instrument.

How the Ruffed Grouse Drums. I have watched at the distance of a dozen feet the beginning, progress and ending of at least a hundred drummings. Each instance was a demonstration of at least one fact—that the forceful, sound-producing blow is the *outward and upward* (not the downward and inward) motion of the wings (figure 96)! During about half of a given performance the wing-beats are separated by quite appreciable intervals, and for at least so much of the drumming the foregoing explanation particularly holds; then the strokes come so close together that the sound of each merges with the next to produce the whirring of the "muffled drum" (figure 97). No doubt this latter part of the drumming is caused about equally by the upward and the downward movements of the wings, the drummer's equilibrium being main-

tained by the one motion offsetting the next. Thus a rowboat will remain in one place if the oarsman attempts to row forward and backward, alternately, without turning his oars or raising them from the water. On first thought one might well doubt that a grouse or any other bird could *extend* its wings with sufficient force to produce a "thump" on the air audible for several hundred feet and even several hundred yards. I was so strongly inclined to this doubt that the bare possibility of the thing was a long while in occurring to me at all! Yet, seeing the feat actually accomplished over and over again, I now know it to be a fact. Note, however, in this connection, the force with which domestic pigeons and certain other birds strike their outward blows with their wings in fighting.

I believe I am fully prepared to state that the drumming is caused by the wings striking the air, alone. Whatever part in the sound may be taken by any other part of the bird than his wings must be very slight and merely incidental. In support of this statement attention is directed to the accompanying photographs with their explanations. The stiff primaries give forth the loudest part of the sound; the soft innermost secondaries, the least. The entire "thum" of each wing-beat is simply the total sound from all the wing feathers heard in unison. All bird students of any considerable experience, and hundreds of others, have occasionally seen a bird suddenly flash out its wings on the impulse of some alarm, the sound produced by this action sometimes being audible for several yards. The motion in this gesture is about the same as that of the drumming Grouse. Even in the silence with which the frightened bird brings its wings back to rest, upon finding the alarm was false, there is a likeness to the case of the Grouse. After the outward and upward motion in each beat, as long as the eye can clearly follow these the wings seem almost to fall of themselves or to rebound from the impact on the air in the upward stroke, then hang limp from the bend of the wing, often with a quite perceptible pendulum motion, until the next upward flash (figure 98).

When about to drum the Grouse usually sets his feet carefully as a man does in preparation for a standing broad jump (figure 99). But first the bird is likely to turn around completely once or twice as if bent on trying a new direction (figures 100, 101). Grouse No. 1, for example, had the habit of frequently doing so, always ending up quite comically by facing the same old way when he began to drum. That is the rule almost without exception; each drumming log is a one-way affair in that respect. For instance, logs No. 1 and 2 pointed in the same direction; yet the Grouse always faced west on number 1 and east on number 2 when drumming (figures 102, 103). The turning around reminds one of the similar acts of dogs before finally lying down just where they started.

Now, with the first preliminary wing-beat, the body of the drummer snaps into a more upright pose, the neck and chin feathers



Fig. 99. When about to drum the Grouse usually sets his feet carefully. Note the movement of the bird's left foot; the motions suggest a cat "making bread."



Fig. 100. The bird is likely to turn around once or twice, as if bent on trying a new direction — which he *wont!*

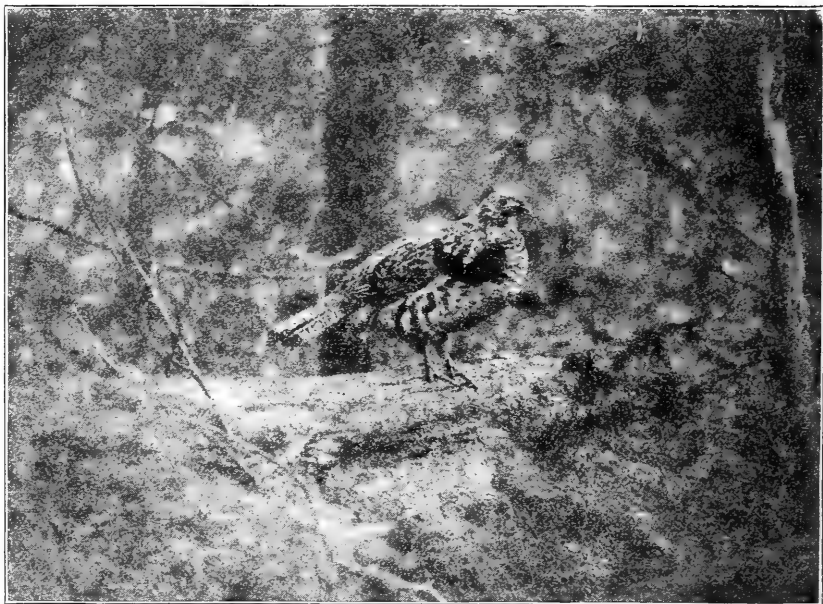


Fig. 101. Turning around before drumming. Although the Grouse seem to "consider" facing a different direction to drum, they customarily face the same way on any given log.



Fig. 102. The drumming now begins in earnest, following the first slow, almost noiseless strokes. This Grouse always faced west on Log No. 1, when drumming.

are greatly expanded and the bird peers straight ahead absorbedly (figure 104). The performer first tries his drum-sticks before each and every exhibition! The first one or two of these wing-beats may be quite inaudible even at a distance of only ten or twelve feet, but with the next few succeeding strokes the proper volume is attained, — the instrument is, so to speak, brought into tune, — then follows a short second's pause before the drumming begins in earnest (figure 105). Those first beats appear to be partly to reassure the bird that he has plenty of elbow room. It struck me as very much the sort of thing that a man does when he extends his arms a couple of times before he carves a roast or pitches a horseshoe. In fact I have once or twice detected an interrupted motion of the wings at this stage; there seemed to be a twig in the way or else something wrong with the overlapping of the wing feathers; — again the suggestion of a man giving his arms an extra twitch to adjust an interfering cuff or sleeve before proceeding seriously with the business in hand. This brings us to another point; the drumming is quite voluntary and under the bird's control, although the contrary has been suggested. Many times have I seen the drummer pause abruptly in mid-action and "register alarm" until the dog or hawk or other cause of disturbance had passed on. In approaching the drummers under entirely natural conditions the stalker will find them sufficiently keen to hear and see! Apparently they are alive to the fact that their drumming is an advertisement of their whereabouts to enemies as well as others. However, their manifest alertness notwithstanding, they are perforce rather deaf to ordinary footfalls during the brief accelerated frenzy with which the drumming ends. This is the part of the performance for which I early learned to wait while stalking the Grouse without the aid of a blind, or when approaching a blind to which no pathway had been cleared. They are all alert once more as the drumming ends, and pause as though listening for the response or echo (figure 105).

The drumming sound has been too often described to need a lengthy description here. It can be well summed up as a series of dull thumps or "thum"-s, continuing for about a quarter-minute; and while at first separated distinctly (figures 96, 102), they gradually and steadily become closer together until they merge in a spasmodic burst of fluttering as the drumming ends (figure 106). Considered by itself, any one of the drummings is very much the same as a hundred others; the variations are difficult to detect; certainly there seems to be rather less individuality than for example in the songs of Robins, Orioles or Song Sparrows.

Everyone familiar with the sound has noticed its ventriloquial quality that makes the whereabouts of the hidden drummer difficult to determine, as to both distance and direction. However, as I found out early in my experience, there is one point at which the sound always loses its ventriloquial disguise if the hearer be sufficiently near. In that diminutive tornado previously referred to, with which the drumming ends, the element of elusiveness seems to be wanting. The contrast between this final wild fluttering and the

vagueness of the preceding wing-beats is striking. Often, too, it brings quite a surprise to the listener, suddenly revealing that the bird he had fancied some two hundred yards or more away is in fact not a quarter of that distance and in a decidedly different direction than he had supposed.

Like the singing of other birds, the drumming of the grouse is most frequent and regular near sunrise and sunset. At these times the drummer will often remain on the log for an hour or more. It is more usual, however, for him to leave the log and walk about feeding near by at intervals of ten or fifteen minutes. On the latter occasions he is soon back again, looking very trim and well-groomed and alert as he hops to the top of the log (figure 107).

New Facts About the Habit. There follows a summary of the observed points for which I have been unable to find previous authority among writers on drumming Grouse. But perhaps this statement needs qualification as regards the striking of the air being almost or quite the sole cause of the sound;—I believe this point has been heretofore largely a matter of assumption, when it has been stated at all.

1. The outward and upward motion is chiefly responsible for the drumming sound, particularly during the first half of the performance, the inward and forward motion of the wings being for the most part silent, or nearly so.

2. The striking of the air alone with the wings is practically the sole cause of the sound.

3. The fluttering with which the drumming ends is devoid of the ventriloquism which marks the preceding part of the performance.

4. Frequently the grouse turns round and round like a dog before beginning to drum, and almost invariably faces in the same direction when drumming on any given log.

Methods In Watching and Photographing Drumming Grouse. My systematic observations in 1921 began on April 9 and ended on June 8. For that period two grouse in particular were under observation almost daily, each for from one to four hours and more at a time. The locality was about two miles from Brownville in Jefferson county, New York. I established my headquarters, a small tent shelter (figure 108), a few hundred feet from the drumming logs which I discovered were being used regularly. This tent was of canvas, about six feet long, and painted dull green. In it I spent many nights so as to be within easy hearing of the grouse at all hours. One of these drummers used about equally two logs approximately two hundred feet apart. The other bird used only one log with any regularity, but did occasionally drum from one or another log or stump from fifty to a hundred feet from his favorite station. Near each regularly used drumming place, as it was found, I improvised a blind or hiding place. Using in each case some nearby stump or tree as a nucleus, I first built up a wall having a peephole commanding the drumming log, and then added the sides as necessary. Blinds number 2 and 3 had neither



Fig. 103. The same Grouse faced east on log No. 2 when drumming. The picture shows him about to begin the performance.



Fig. 104. With the first preliminary wing-beat the body of the drummer snaps into a more upright pose. Note the characteristic lifting of the neck feathers at this stage.

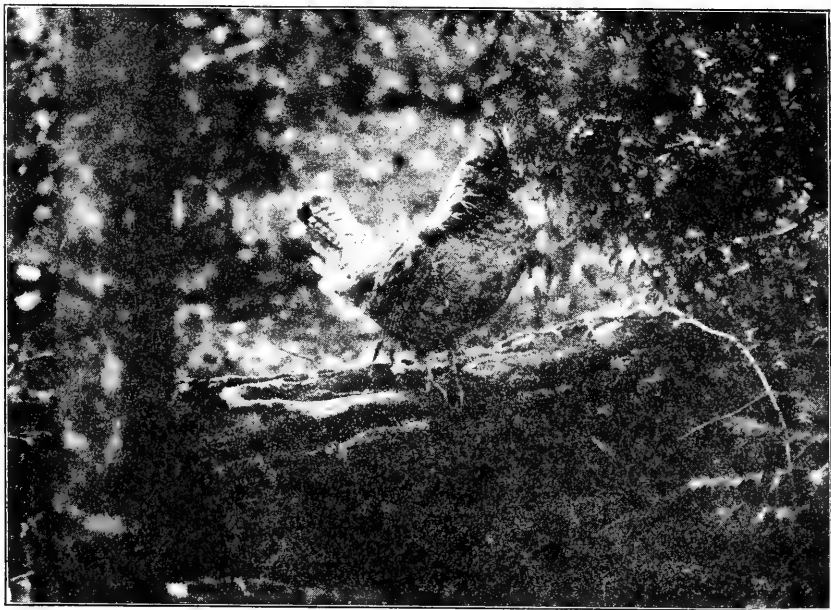


Fig. 105. Pausing, as if listening for the response or echo. The drumming has just ended.

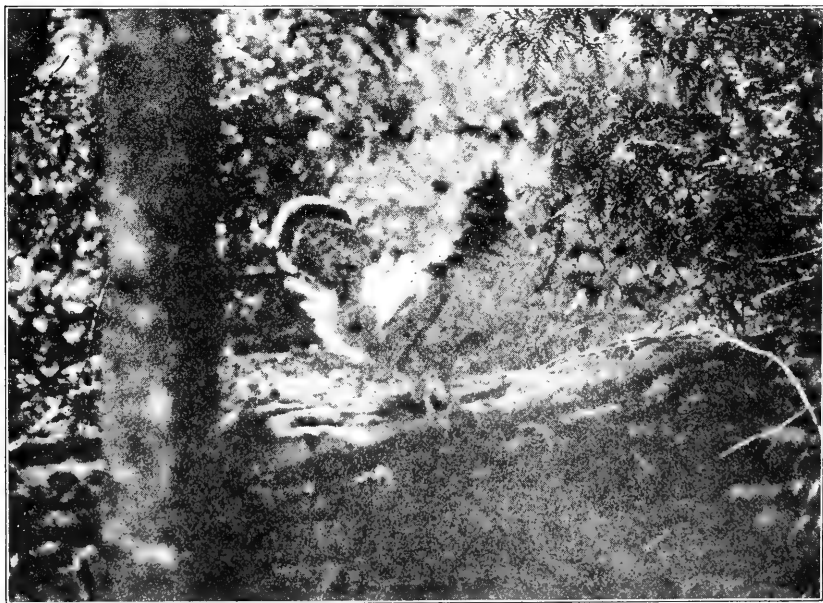


Fig. 106. The drumming has just ended. Note the "mussed up" appearance of the bird, and the tail as it is characteristically raised at this juncture.

top nor back (figures 109, 110). Number 1 was a brush hut shaped like an Esquimo house, and therefore was so conspicuous that the grouse avoided the nearby log for several days. During the interval this grouse had established himself on a log some two hundred feet away. Near the latter log, profiting by the failure of my former venture, I made for a blind only a breastwork of brush, bark and dead leaves; low sides were added a day or two later. This blind was begun about 11 a. m., on April 9. Four hours later I was peering through the peephole at the grouse which had been drumming at four-minute intervals for some twenty minutes.

From blinds number 1 and 2, I repeatedly heard distant drumming. Upon investigation I flushed a grouse from his drumming log about one hundred fifty yards away and beyond a clearing in the wood. Here I at once proceeded to make blind No. 3. For this one I used as a base a convenient old pine stump (figure 110). The stump was first torn open, then hollowed out and spread apart and somewhat patched with bark and dead leaves; a peephole next cut through the side of the stump needed no camouflaging to pass for a Woodpecker hole.

Each blind was approached from the rear by a narrow path cleared of all brush, dry leaves, twigs and branches for a distance of fifty or sixty feet. This arrangement enabled me to go to and from the blinds unseen and unheard while the grouse were on their logs. One of the drummers would discover me only when he chanced to walk from the log and stroll well around toward my rear. This happened several times. By crouching low I sometimes escaped being seen; and the grouse, after feeding awhile, would return unalarmed to the log. But again, crouch as low as I might, the reiterated "preent, preent" of his alarm call told me I had been detected and that the game was up for that half day. To shield my movements in going and coming the peephole of each blind was provided with a small curtain of dark cloth tacked along its upper edge to the inside of the blind. The glint of the camera lens was shaded by a tube of black paper fitted over the lens mounting. At first it was necessary to be quite careful to muffle the various "clicks" of my graflex camera, this being done by holding a handkerchief or a folded shirt over the adjusting keys when setting and releasing them.

At log No. 3, the usual distance from camera lens to the bird was slightly under eleven feet, or about four feet less than at log No. 1, and six feet less than at No. 2. At this log No. 3 my first snapshot was made between wing-beats as the drumming began, but it alarmed the bird (figure 111). At the fall of the shutter curtain my subject bounded up with a loud whirl into a nearby tree. In fifteen or twenty minutes I heard him fly to the ground and he soon appeared on the drumming log gingerly walking to the drumming spot. Here I got in a dozen shots at him within the next hour, having contrived to deaden the noise of the falling shutter; still the sound was certainly loud enough to be audible at several times the distance. After the first few weeks neither of these birds showed

any special alarm over the operation of the camera. Whether bark of squirrel, rustle of scampering chipmunk, cry of Blue Jay, fall of shutter curtain — each was merely an occasion for the same inquiring stare, soon to be forgotten in the interest awakened by the next small wood noise (figure 112). Before my season with these drummers was over I had removed the paper tube from my lens and was no longer so cautious about muffling the clicks of the camera or the noise of changing film rolls. For the latter operation I had at first retired to a distance of a hundred feet in the rear of the blind. Toward the last the loading and unloading was done inside the blinds, often within eleven feet of the grouse.

For the first few weeks Grouse No. 1 kept me waiting for many an hour at one or the other of his two logs. He had a provoking way of shifting his base of operations just about the time I would get nicely ensconced at either log, and he might not reappear for the remainder of that half day. One day a happy thought came to me after listening for some time to the drumming which had been coming with provoking regularity and persistence from log No. 1, I being at No. 2. Doubling up my fist and using the bare ground in my blind for a drumhead, I beat an imitation of the sound; silence, intense, for about three minutes; then my friend hopped upon the log before me and appeared to look around for a supposed usurper of his throne (figure 113). In another minute or two he drummed; — he had decided to remain. That was not the last time the trick was worked successfully. Just what chord in Grouse psychology the ruse plays upon I am not sure; perhaps it is purely a sense of proprietorship, identical with that so common to breeding birds generally, over a more or less definite and restricted section of their home woods.

Experiences In a Grouse Blind. It must not be inferred from the uniformity of the drumming itself that the hours spent in a blind beside a drumming log are wholly monotonous. Indeed, the very wildness and seclusion of any spot implied by a drumming log constitute assurance that the grouse will not be one's only caller. Among the incidents tending to relieve the tedium of waiting between acts are the visits of many birds as well as squirrels, chipmunks and wood mice. Many times have I seen both red squirrels and chipmunks use the drumming log for their highway. Usually the grouse would politely hop to the ground to let the four-foot pass; again, not infrequently, with half-raised tail, expanded wings, and with head bent partly down in a mildly threatening attitude, the bird stood his ground and the squirrel was obliged to detour. Both grouse were fond of bugs or other similar wild-life victims. It was interesting to see them spring down, as they frequently did, in pursuit of one of these "small deer" on the ground near by. Grouse No. 1 in particular was quite surprisingly adept in this hunting, suggesting even a vireo or a warbler by the speed and grace with which he would dart from his log and snap up some small passing bug or other. The following are a few sample pages from my note-book.



Fig. 107. After an interval of feeding, he is soon back again looking very trim and alert as he hops to the top of the log.



Fig. 108. Headquarters of the author in 1921 while studying drumming Grouse. The tent is of canvas, painted dull green, and about 6 feet long.



Fig. 109. Blind No. 2 as seen from the rear. A breastwork of brush, pine boughs and birch bark.



Fig. 110. Blind No. 3 from the rear. An old stump hollowed out and remodeled as a screen for photographing and studying Grouse.

"May 1st.—Made 15 snapshots of grouse from blind No. 1 while watching him for one and a half hours about noon. Until about 11:00 or 11:30 A. M. it rained gently by spells with no direct sunshine between, then the sun shone for brief periods for an hour or two. Until about 11:30 hardly a grouse was heard; then the drumming began, apparently in two or three places, within hearing from my tent two hundred fifty feet from blind No. 1, and it continued with the usual regularity at the latter station until I left the thicket entirely or at least beyond hearing distance of the log. From about 11:00 to 12:30 I watched the grouse, the rain having stopped. His actions were as usual except that he seemed as peevish as a wet hen over his dampened feathers, shaking himself vigorously a few times and preening [see figure 114]. Once he left the log and soon I heard him shaking himself, apparently close to the blind and directly in front of it. When a dog barked and yelped and came rushing along until probably about two hundred feet from the log the Grouse was quite alarmed and started a few times as if to leave the log; then the dog as loudly and rapidly retreated, whereupon the grouse at once "registered" false alarm and drummed [see figure 115], the dog still barking one hundred and fifty yards away. This is the blind I entered a few days ago, alarming the grouse before I could reach the peephole, and thereupon he had flown to the lower branches of a cedar above the log, twitched his tail characteristically while for several minutes he sounded his note of alarm, then hopped to the ground and disappeared. Then I had fixed up the blind inside and out with a screen of cedar boughs. Evidently I was better hidden today than heretofore; twice today I changed film rolls in the blind, the Grouse being on the log. Last night I heard warblers in the thicket and saw one or two Black-throated Greens. White-throated Sparrows sang at dawn this morning. Robins have all along been numerous in the thicket, with several Purple Finches and an occasional flock of Cedar Waxwings. Blue Jays and Chickadees are numerous here. Field Sparrows are numerous in the surrounding clearings."

"May 5th.—For the first time I saw a grouse actually strutting, tail raised and fully spread, chest expanded, crest raised [see figure 116]. This was Grouse No. 2. The bird had stopped in the midst of drumming; when I looked out to see the cause he was in this strutting attitude and walked a foot or two back and forth, turning round slowly a few times. His attitude suggested a spectator in the form of a mate, but I saw nothing of the latter. His alert and watchful mien was different from a turkey gobbler's self-engrossed manner. He drummed rather briefly once or twice in the strutting attitude, with tail raised and expanded throughout the act. After strutting two or three minutes he soon left the log."

Much has been said and written about the "lordly strutting, like a proud turkey cock" of the male Ruffed Grouse. My own observations, however, seem to indicate that the strutting is far less common than reported and that it is rather more a matter of attitude than action; in particular, that it is *not* like the blustering strut of the

proud turkey cock but, on the contrary, marked by silence and watchfulness. Of the eight or ten Grouse I have watched for hours at a time, daily, covering altogether the entire breeding season, only one—as above noted—showed any sign of strutting and then only on one or two occasions for a few brief minutes (figure 117). However, I fancy the strutting is mostly done in the presence of the female, or at least when her presence is suspected,—that it is essentially a *mating* habit, and hence is most commonly practiced very early in the spring; earlier than most of my observations have thus far been made.

“May 14th.—Made several snaps of the grouse from blind No. 3. Here a Black and White Warbler visited me, coming within a yard of my face; then he went round to the front of the blind and viewed me through the peephole. I have seen both grouse run suddenly off their logs after some bug or fly, then wait leisurely back. Grouse No. 2 seems crop-bound or to have some such ailment; today he repeatedly acted so. I watched him from 7:30 till noon when he left the log and I soon heard him clucking loudly and continuously—I think for a mate—some 60 feet to my left, in which direction he had disappeared.”

“June 1st.—Flushed Grouse from beside log No. 1. No drumming heard or other Grouse seen.”

“June 8th.—Flushed Grouse from beside log No. 1. Watched No. 2 drum a few times.”

A Tragedy of the Woods. This bird No. 2 continued to show evidence of sickness, persisting in moping and dozing. After drumming he would lapse almost immediately into a sleeping posture, often half closing or even entirely closing his eyes drowsily. Shortly before his next drumming he would come out of his stupor (figure 118); the drumming seemed to be a duty that had to be gone through with. I greatly feared some marauder would get him.

By this time (June 8) the drumming had become irregular and undependable. Stripping my blinds of the cloth curtains over their peepholes and carefully measuring the respective distances from blinds to drumming logs, I “called it a season.” Yet one grim note remained to be added.

About the middle of June, finding myself again in the Grouse woods, I visited the drumming logs once more. Nos. 1 and 2 had been in recent use. No. 3 had apparently been unused for several days, and the reason was not far to seek. A few small body feathers, which strewed the spot, were no cause for alarm; such feathers are not at all unusual in these places where the grouse do a good deal of preening (figure 119). But here also was a tuft of black feathers from the ruff! I was suspicious. Almost at the same time I discovered one of the flight feathers, then several others, all on the ground within a few feet of the drumming spot. Of course that settled it; here were the very drumsticks, wrenched and thrown away! *Bonasa*, afflicted as I noticed he had been, had dozed once too often or a moment too long and, in consequence,



Fig. 111. A drumming Grouse interrupted and alarmed by the click of the camera during a performance.

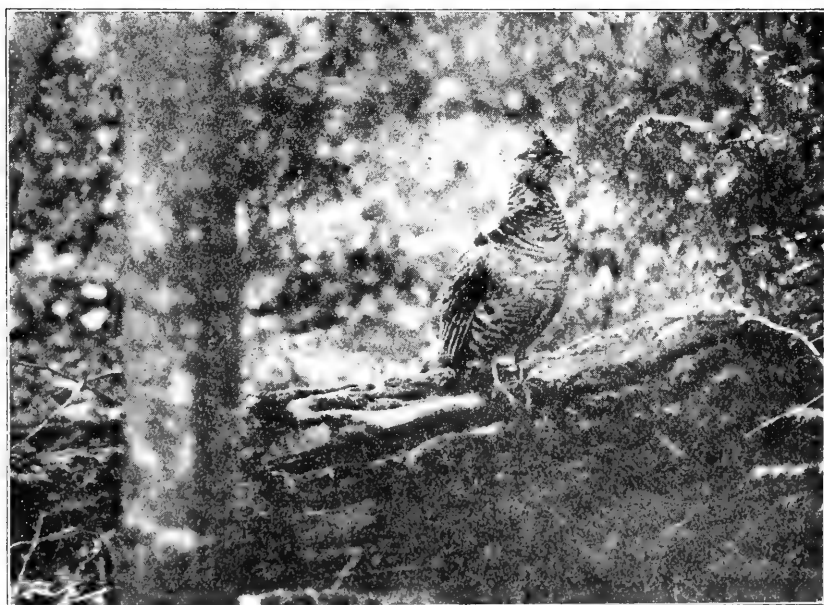


Fig. 112. After a time the noise of the camera shutter was regarded only with an inquiring stare, and soon forgotten in the interest awakened by the next small wood-noise.



Fig. 113. Deceived by the ruse of thumping on the ground, the Grouse hopped upon the log and appeared to look around for the supposed usurper of his throne.



Fig. 114. On a rainy day. The drummer seemed as peevish as a wet hen, shaking himself vigorously and preening.

had met the fate I had feared for him. Evidently he had not seen the fox or bird of prey until it had actually pounced on him. As to whether or not he has left some lusty heir to inherit his well-worn log I can not now tell for certain. However, another year has nearly rolled around. It is drumming-time again. For a week or more logs Nos. 1 and 2 have again been in use. But there is as yet no drummer on log No. 3.

Why the Grouse Drums. Now, why does the Ruffed Grouse drum? What does the drumming mean? I believe with those who think the drumming closely corresponds to the singing of other birds,—that it is just as much, and no more, a nuptial performance. Although heard occasionally at various times throughout the year, it chiefly coincides with the mating and nesting season. Through August, when song birds are particularly silent and retiring, there is almost no drumming to be heard in the woods. As autumn comes on the drumming breaks out again; so does the singing of orioles, vireos, sparrows and various other birds which regularly have a post-nuptial song season. But I have rarely heard a grouse drum in winter. At any rate the broad fact remains; springtime, mating time, nesting time—is the time of the male bird chorus and the time when the cock grouse drums with daily regularity and hour-long persistence. The bloodroot, hepatica, anemone and trillium, now blooming, form the proper setting for the drumming log (figure 120). The time of these flowers is the time of the birds' spring choral. And how lacking would be the concert without that strangely haunting, bewitching sound,—the most potent in all nature to revivify a thousand memories of our woods in spring,—the muffled drum of the Ruffed Grouse!

The Human Appeal of the Drumming. It is early in April that this new voice of the woods begins to be regularly heard. To those who have long been familiar with the sound it means the babbling of trout streams, the drowsy humming of the earliest bees, hawks tracing out anew their circles in the sky, and a hundred like signs of the season. Other birds may come to you with their songs; often they come at unexpected and inauspicious times and places. To hear the Ruffed Grouse beat his "muffled drum" you must visit the stilly wood where he has secluded himself (figure 122). So it is that every charm which goes to make up the typical spring-time woods comes crowding back with overpowering associations whenever the initiated hear again that magic sound;—the seclusion, the still air, the gentle rustle more potent than silence for rest and "pleasure in the pathless woods"; the dry leaves turned by growing green things; the calm, the serenity of it all; and then the drum, "thum — thum — thum — thm — thm — thm-thm-m-m-m-m-m-mmmmm"; the drum that beats for peace! Listen to that exhilarating tatoo; listen to that echo of your own throbbing heart.

NESTING OF THE RUFFED GROUSE

The Nest and Eggs. All the nests I have found of the Ruffed Grouse have been in dry parts of the woods. Most of them were built close beside a log or at the base of a sizeable tree; a few were sheltered only by fallen brush or branches. In every case the nest itself was well hollowed and well lined with dry leaves or pine needles.

The eggs are of a clouded or dusky cream color, usually more or less freckled with small spots a few shades darker. With two exceptions, the nests I have found contained from 8 to 13 eggs. One nest was found when only the first egg had been laid.

On May 14, 1922, near Blossvale, N. Y., I made quite a different but not less remarkable find. Upon discovering a sitting grouse on May 13, I had stolen away without flushing her. The next day I took along two children who were bird enthusiasts to share the sight, little thinking what a rare spectacle was in store for us. The sitting grouse was only slightly screened by a thin lattice of brush and the nest was so close to the base of a tree that the tail of the sitter touched the bark,—a typical location. At a distance of twenty feet we stood admiring the picture. One, two, three minutes she sat, her large eyes turned on us, as motionless throughout as any statue in bronze. Then she suddenly and noisily rushed from the nest a distance of a foot or two and sprang into the air with a vigor and noise of flying leaves that was remarkable even in a grouse. (This manner of departure is so frequent an occurrence that I am satisfied it is not wholly by accident that the eggs are commonly strewn with leaves. I remember one nest which had been thus completely covered over with leaves, and entirely hidden, although I had just flushed the sitting bird.) We hastened to look into the nest. A leaf or two had been fanned onto the eggs. The latter formed a single saucer-shaped layer more than covering the bottom of the leaf-lined hollow. One, two, three—we counted; thirteen, sixteen! twenty!!—the largest clutch I have ever seen.

On May 28 the grouse was still sitting; the eggs were unhatched. On June 2 the nest had only empty shells and two unhatched eggs. The shells were mostly in two pieces only. A systematic search through the woods failed to disclose the brood; they had evidently gone at least 150 yards from the nest.

Making Friends With a Ruffed Grouse Chick. On May 28, I found, one hundred yards from the nest of twenty eggs just mentioned, an old grouse and her brood of two or three days old. Employing the hiding and calling tactics described elsewhere in this paper, two of the young were caught. One was taken from the woods and photographed in the hands of my daughter (figure 121). Two hours later we brought it back to the woods, where, after feeding it several flies and other insects, we let it go free. Then came the big surprise. Instead of running away into hiding it at once began to follow us, puppy-like, stopping when we stopped, soon finding and catching up to us if we hurried ahead. When we sat



Fig. 115. Just after the drumming. The tail still raised, but gradually falling back to normal.

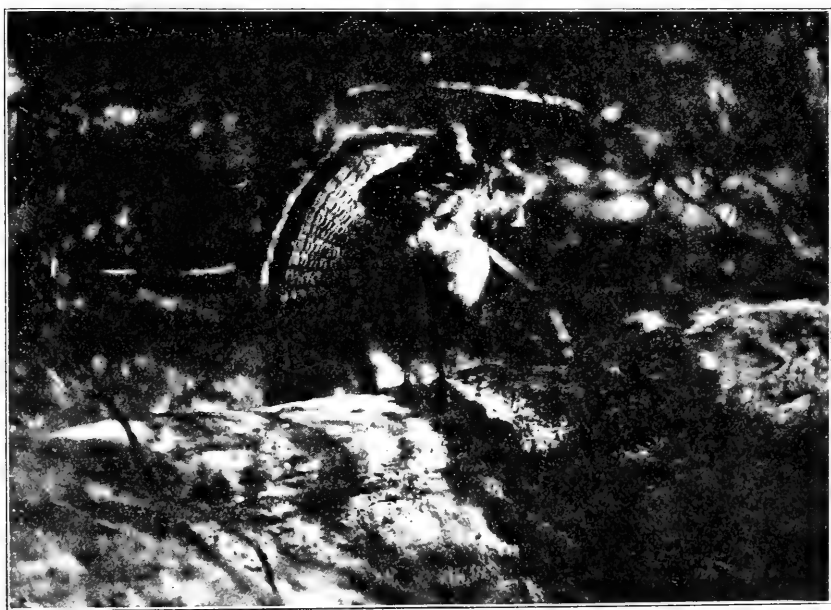


Fig. 116. Strutting. In this case the bird stopped in the midst of drumming, assumed this strutting attitude, and walked a foot or two back and forth.



Fig. 117. Beginning to strut. Only one Grouse showed any sign of strutting, and then only for a few minutes at a time.



Fig. 118. Bird No. 2 continued to show evidence of sickness. Before his next drumming he would come out of his stupor, then relapse into drowsiness.

down it went round and round us trying to squeeze under us. It also climbed to my daughter's head where, peeping with a new note of content, it wriggled quickly under her bobbed hair. Its ability to pick its way surely and rapidly over, under or through the obstructions of brush, logs, tussocks and shoots and then to locate us was truly marvelous. Observing that it already could and did now and then pick up a fly on its own account, we felt assured that it could make its own way in the world and left it to do so or else find its brothers and sisters.

On June 4 I had another meeting with a young grouse chick which may have been a real sequel to the foregoing. With a boy of fifteen I was crossing an open field some three hundred yards from the spot where the grouse chick had been let go seven days before. Here we very unexpectedly came upon a young grouse about one week older than the other chick. This field adjoined the same piece of woods. There was no sign of any other grouse, young or old, about. Under these extremely exceptional circumstances it seemed unavoidable to infer that here was my little acquaintance of the preceding week. Apparently he had wandered to this place where, by the way, small grasshoppers seemed to be abundant, through having no guiding parent to keep him in his natural habitat. He was about as wild as a domestic chick of the same age. He would struggle to escape, and did escape, from my hand; but, when I offered him flies and grasshoppers, although he did not take them, he would sit very still as if some dim recollection had come to him. I soon let him go, but I believe he would have eaten from my hand within an hour or two.

FAMILY LIFE IN SUMMER

For the element of human interest summer is perhaps the season which will best repay the field observer of the Ruffed Grouse. But it is not now the bird of thundering wing, or beating the mysterious drum, about which interest centers. The point of focus now is the brood of charming young with their watchful, crafty, resourceful mother.

Many, many times have I heard some hunter or backwoodsman telling the old, old story of the chicks disappearing as if by magic and then of the "cute little rascals" being found, *each one on his back, holding a leaf over him!* Repeatedly have I tried to verify the story by experience, but always in vain. The tale is a myth. Again and again I have come across the anxious mother and have always looked for the young. My method is to let the fluttering bird lead me a short distance away, then make a sudden sprint at her, forcing her to take wing to a considerably greater distance; whereupon I at once hasten back with all speed to the place of our first meeting, here to conceal myself as best I may. There follows perhaps ten minutes of silence. Then comes a low, mewing note, "pe-e-e-u-u-r-r-r." The note can be imitated by trying to pronounce the word "pure" in a strained, tremulous way with the

mouth nearly closed. Soon there is an entirely different note like the low clucking of a hen or turkey; this grows louder and more confident and I catch a glimpse now and then of the watchful hen picking her cautious way back among the low plants. "Tsee—tsee—tsee-e-e-e," answers a chick here and there about me, all unseen. "Puck-puk-puk," from the mother; "tsee-tsee-tsee-e-e-e," from the chicks, and one of the latter comes flying down from some leafy, lower branch; "tsee-tsee-tsee"—and another appears from around a stump or log. There follows more calling back and forth, more chicks come out of hiding and already the "puk-puk-puks" have begun to grow faint in the distance as the mother quickly leads the brood off under cover of the ferns. I have on two or more occasions discovered one of the chicks in his hiding place on the leafy ground. In each case he was merely squatting there, his coat of mottled down perfectly matching the browns and grays of the forest floor.

By the last of June the young are the size of the Bob-white or Quail. From about this time onward through the summer a favorite pastime, if not a necessity with these birds, is dust-bathing. The mother or one of her brood, alone, may be the bather; again, the entire family may indulge. It is seldom that the observer is so fortunate as to discover the birds in this interesting act. But the recently vacated dusting spot is full of keen interest for the reader of the sign language of the woods. The bath may be a certain sunny spot on some logging road or at the edge of a clearing; again, it may be a crumbling, dry, old log along which the whole family has ranged itself, each member in his own individual wallow.

All summer long the family holds together, growing fat and lusty on insects and berries. The father, however, seems to drop out of sight after the drumming season. His presence with the family in summer seems to be only casual. The accompanying plate, therefore, shows a scene more ideal than average (plate 29). I have now and then flushed the whole covey even in autumn. I believe this is the normal condition and that it is chiefly because of their being broken up and scattered by shooters and their dogs, or other enemies, that more coveys are not found intact as late as November at least.

LIFE OF THE RUFFED GROUSE IN WINTER

The regular winter diet of the Ruffed Grouse consists of the buds of various trees; birch and poplar are favorites, and occasionally he visits an apple orchard. Hence the winter and very late autumn are known as the "budding" season. The budding birds must be pretty watchful and quick to take cover in the undergrowth, for I confess I have very seldom been able to surprise them in the upper branches where no doubt they often feed. Still, they prefer the ground. Their tracks are always to be expected about heaps of newly-cut brush. They like to follow the axeman and snip the buds of trees he has brought low.

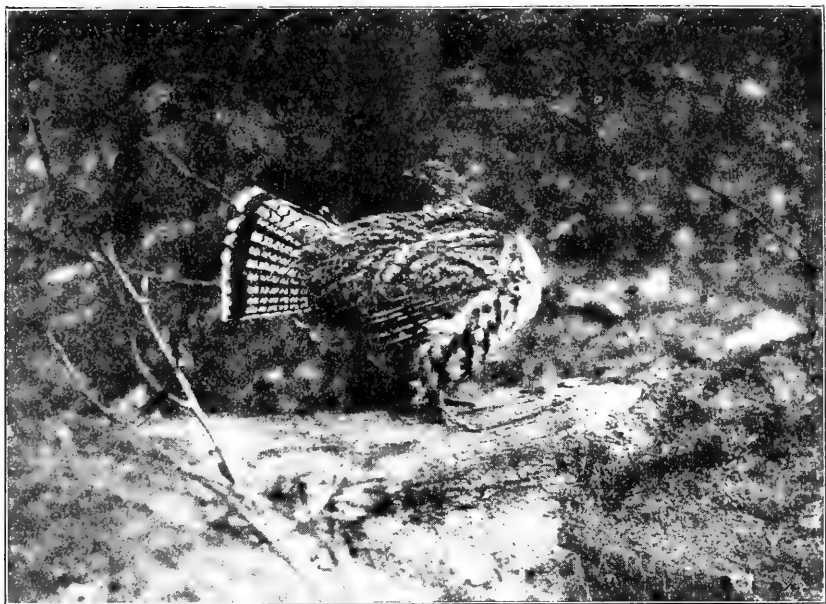


Fig. 119. Preening. Note the outer tail-feather which the camera caught before it snapped back entirely after its release from the bird's bill.



Fig. 120. A drumming log in June—toward the last of the regular drumming season.



Fig. 121. A confiding Ruffed Grouse, only a few days old.

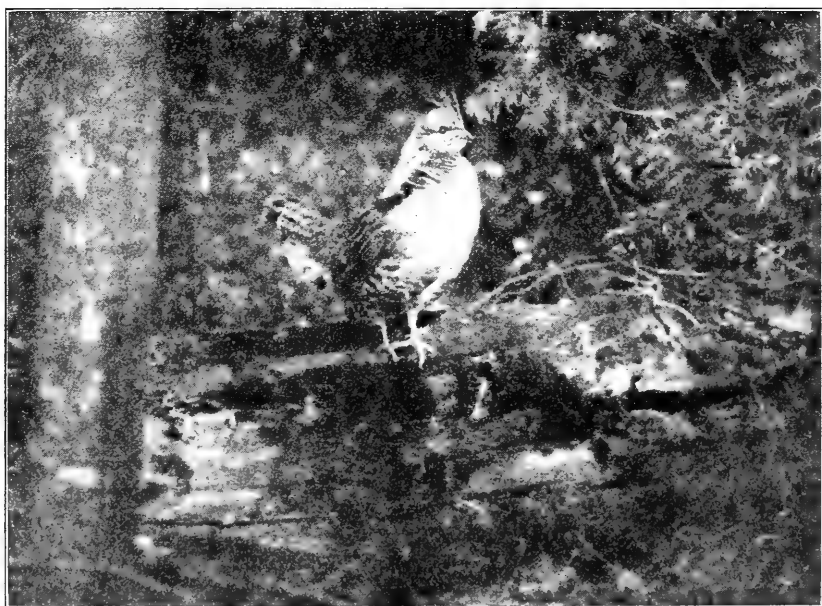


Fig. 122. Deep in the forest. To hear the "muffled drum" you must visit the stilly wood where the drummer has secluded himself.

More interesting than his winter feeding is the winter sleeping quarters of the Ruffed Grouse. Where the snow is deep and soft he commonly burrows or dives into it for the night. More snow may fall before morning, and often the Grouse finds himself covered a foot deep. Now and then a crust may form on the surface and so imprison him seriously. In some regions where in certain years the total number of Grouse has been greatly reduced this has been the alleged cause. Personally, I find but slight ground for this explanation and I believe it must be a very rare occurrence on such a scale.

THE KING OF GAME BIRDS

Full of interest as is the Grouse to the lover of nature and of birds in particular, he is perhaps most widely known and most familiar to sportsmen. In all the eastern states this is by far the most important land game bird. The Bob-white, where he occurs, may share the sportsman's attention; but the Grouse is more universally distributed than the Quail. Doubtless there are those who would say the Pheasant divides honors with the Ruffed Grouse as a game bird, or even that the former is the finer and more desirable bird. The Pheasant is a foreigner, an involuntary immigrant. His colors are the extravagant hues of the Orient. His flight is comparatively slow and labored and his haunts are not preferably and characteristically the woods; rather, they are the relatively open places. These conditions, taken together with his large size, render the Pheasant an easy target and his pursuit a tame sport. How different is the Ruffed Grouse! This hardy native American must be sought in the deep woods. Here he is so much at home that the successful hunter must be pretty much of a woodsman himself. Most hunters employ a dog to find and detain the birds; many shooters would not consider it at all practicable to hunt Grouse otherwise; they regard the dog as no less indispensable than the gun. However, it is only by hunting them without the aid of a dog that one comes to fully appreciate their wiliness and resourcefulness. It should be borne in mind that even in such hunting the game is heavily handicapped. The hunter is armed with that finished engine of destruction, the modern breech-loading shotgun, while the Grouse must depend wholly on his wits and speed. Where is the hunter who would even attempt to match *Bonasa* on even terms!

It is several years since the writer abandoned his gun altogether in favor of the camera and sketch book. And now there is little enough satisfaction in the reflection that that gun shot many a Grouse, albeit all of them on the wing and not one over a dog. I have, after all, never taken a Grouse except through the immense advantage of my infernal powder and lead. I never outwitted him fairly; I have never held his limp form in my hand without feeling the rebuke of those matchless wings. I found no just ground to glory over the dead body of that perfect product of the wild out-

doors, that past master of woodcraft with his wings which so immeasurably outmatched the best my limbs could do; those wings with their damning, rebuking evidence — a drop of lead-tinctured blood. The triumph was all his.

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CURRENT STATION NOTES

THE ALLEGANY PARK BIRD SURVEY

The role which the Roosevelt Station played in the establishment of the Allegany State Park was briefly outlined in the first number of the *Bulletin*. In this number is published the first detailed report of the cooperative wild life survey which has been made with the Allegany State Park Commissioners. The paper by Mr. Saunders is the first inventory of the animals of that region; and in behalf of the Station I wish to express my appreciation for the generous assistance of the Commissioners. Reports on other aspects of the survey will be published in due time.

COOPERATION WITH THE ALLEGANY STATE PARK

As mentioned above, the first number of the *Bulletin* (pp. 62-63) contains a statement of the relation of the Roosevelt Station to the original plan which resulted in the establishment of the Allegany State Park, near Salamanca, New York. The "First Annual Report of the Commissioners of the Allegany State Park" (Legislative Document, 1922, No. 95, pp. 1-98; cf. also, for an abstract, *Hobbies*, Buffalo Society of Natural Sciences, Vol. 2, No. 9, pp. 3-25, and separate, pp. 1-24), contains in addition to the report of the Commissioners two appendices of especial interest, one by Mr. Edward F. Brown, on a general survey of the Park area, including much of the paper by the Director, published in the *Bulletin* on pp. 62-74, on the plans for wild life of this Park, and a second paper by Professor Henry R. Francis, on the recreational resources of the Park. This report, and an earlier paper by P. M. Silloway and Edward F. Brown on the Palisades Interstate Park (Bull. No. 10, New York State College of Forestry), are of particular interest to persons concerned with the recreational and wild life uses of public forest lands.

Not only has the Roosevelt Station been interested in the Allegany Park since its inception, but also it has devoted two seasons of field studies to its problems. In addition to this, it was through the Station that the Commissioners of this Park were put in direct contact with the Washington authorities in charge of war supplies, from whom the Commissioners have secured about \$300,000.00 worth of equipment for the Park, including auto trucks, canvas for tents and much other equipment which has enabled the Park authorities to accommodate the public while its appropriations are yet small.

THE RUFFED GROUSE

The Ruffed Grouse is the most popular game bird in Eastern America. It abounds in the Allegany State Park, and should prosper there under proper care and become both for the sportsmen and for the general public one of its most interesting attractions. The observations begun by Mr. Saunders will be extended in order

to learn by what system of forest and game management this bird may be best encouraged.

The interesting paper and very valuable series of photographs of the Ruffed Grouse in this number of the *Bulletin*, by the well-known bird artist and student, Mr. Edmund J. Sawyer, will be appreciated by many. This valuable contribution to the Roosevelt Station has been made possible through the generosity of several friends, including Mr. J. C. Brennan, Dr. Henry E. Bischoff of the Erie County Society for the Protection of Birds, Fish and Game, and Mr. W. E. Hookway of Syracuse; and plate 29 has been contributed by the author and artist himself. Attention is called to the fact that the colored plates accompanying Mr. Saunders' paper, as well as those in the following issue of the *Bulletin* (Vol. 1, No. 4) on the birds of the Adirondack forest, are the painstaking work of Mr. Sawyer.

NEW PROBLEMS IN FOREST RECREATION

That mosquito control, by means of fishes, should be a practical forestry problem will be a surprise to many who think of forests only in terms of lumber and not as related to other points of human contact. With the intensive use of forests that accompanies recreational utilization by large metropolitan crowds there arise new problems, far in advance of those in remote forests, that demand new methods of attack. While a fish survey was being conducted by the Roosevelt Station, with the view of learning how to properly stock and manage the waters of the Palisades Interstate Park, it was found that many campers were suffering from the bites of mosquitoes. A special examination of the breeding grounds showed that the mosquito larvae or wigglers thrived when out of reach along the shores among water vegetation or behind other barriers. It was also found that when fish had access to these retreats the wigglers did not abound in the water, but they were found abundantly in the stomachs of the fish. In this way and by other methods it was determined that certain kinds of the fish were very valuable in controlling the abundance of mosquitoes.

The plans for this investigation were initiated by Mr. Edward F. Brown, Superintendent of the Camp Department of the Palisades Interstate Park, and were conducted by Dr. J. Percy Moore, of the University of Pennsylvania, working in cooperation with the Commissioners of the Palisades Interstate Park, the U. S. Bureau of Fisheries, and the Roosevelt Wild Life Station. The results of this cooperative survey have been published by the U. S. Bureau of Fisheries in "Use of Fishes for Control of Mosquitoes in Northern Fresh Waters of the United States" (Report of the U. S. Commissioner of Fisheries for 1922, Appendix IV, pp. 1-60, Doc. No. 923, 1922). The cooperative character of this investigation might easily be overlooked, and it should be definitely understood that this was the direct outcome of the Station's cooperation with the Park. The author remarks that "of all the experiments made during the three seasons the most conclusive were those made in the Palisades (Interstate) Park" (l. c., p. 9).

THE ROOSEVELT WILD LIFE MEMORIAL

As a State Memorial

The State of New York is the trustee of this wild life Memorial to Theodore Roosevelt. The New York State College of Forestry at Syracuse is a State institution supported solely by State funds, and the Roosevelt Wild Life Forest Experiment Station is a part of this institution. The Trustees are State officials. A legislative mandate instructed them as follows:

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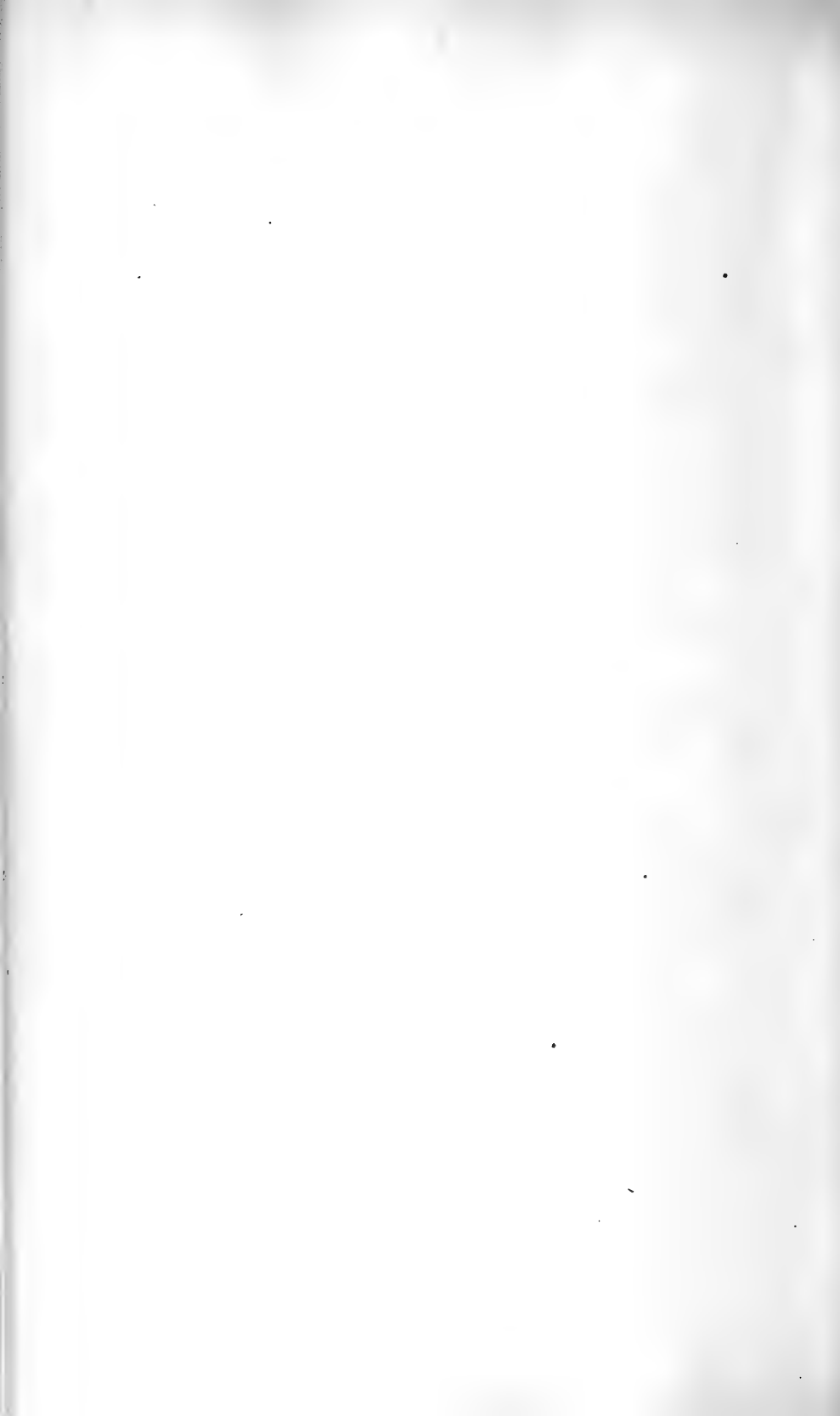
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MAP OF ALLEGANY STATE PARK

SHOWING OPEN AND FOREST AREAS

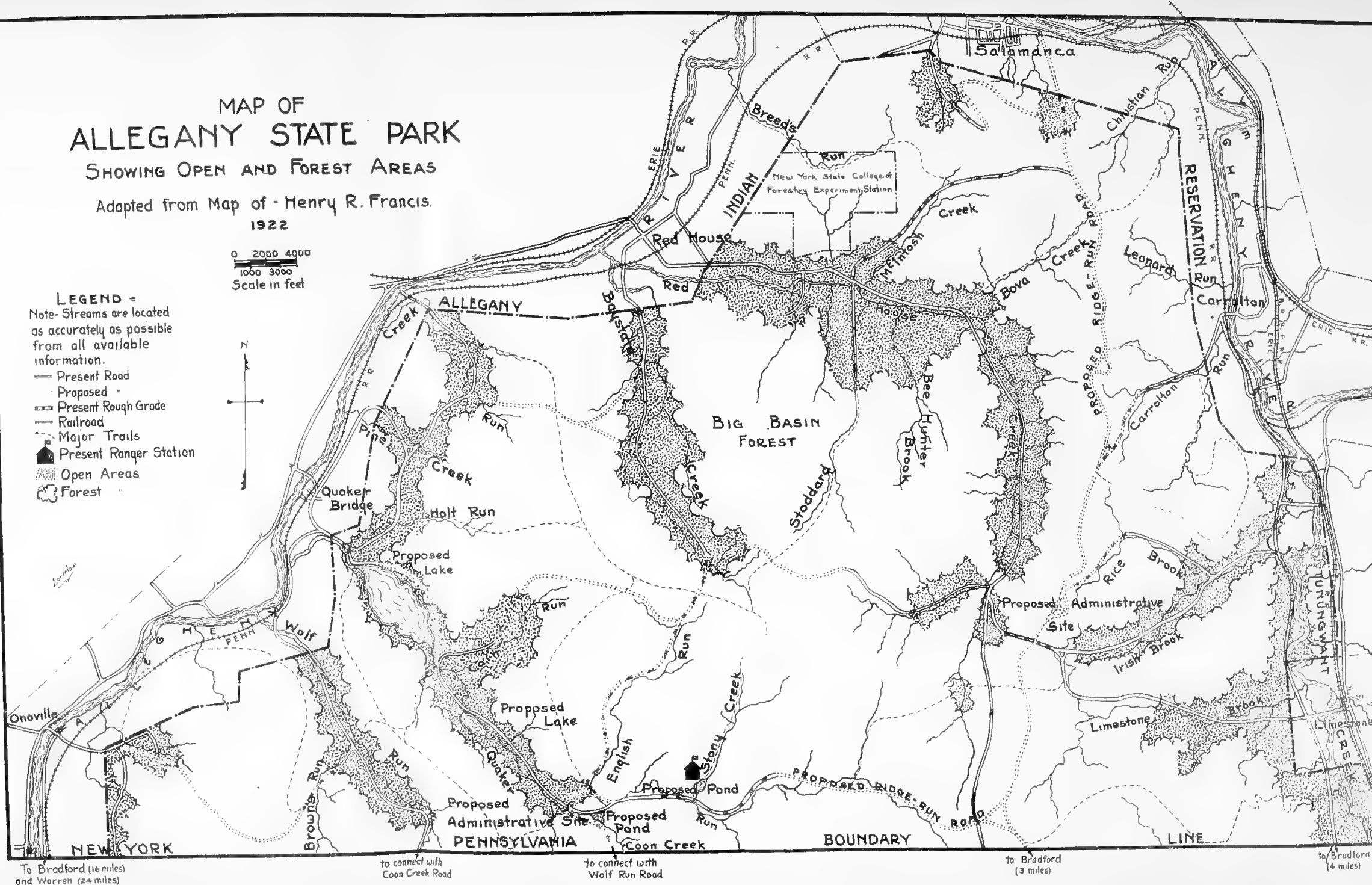
Adapted from Map of - Henry R. Francis.
1922

0 2000 4000
1000 3000
Scale in feet

LEGEND =

Note- Streams are located
as accurately as possible
from all available
information.

- Present Road
- - - Proposed "
- ▬▬▬ Present Rough Grade
- Railroad
- - - Major Trails
- Present Ranger Station
- ▨ Open Areas
- ▨ Forest "



Map. 4. Allegany State Park, showing the open and forested areas.

Roosevelt Wild Life Bulletin

VOLUME I, NUMBER 4

OF

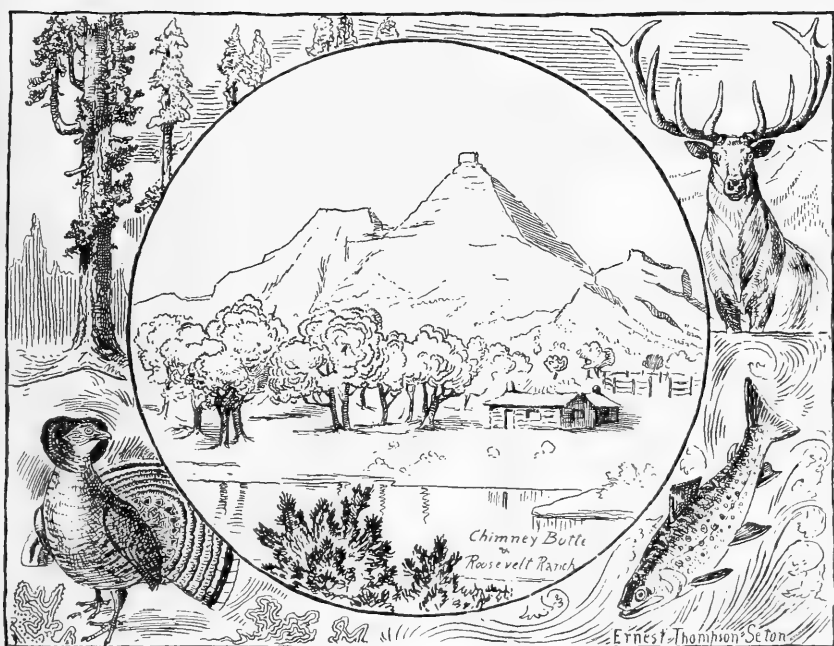
The Roosevelt Wild Life Forest Experiment Station

OF

THE NEW YORK STATE COLLEGE OF FORESTRY

AT

SYRACUSE UNIVERSITY



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The serial publications of the Roosevelt Wild Life Forest Experiment Station consist of the following:

1. **Roosevelt Wild Life Bulletin.**
2. **Roosevelt Wild Life Annals.**

The *Bulletin* is intended to include papers of general and popular interest on the various phases of forest wild life, and the *Annals* those of a more technical nature or having a less widespread interest.

These publications are edited in cooperation with the College Committee on Publications.

Exchanges are invited.

CHARLES C. ADAMS

Director and Editor

[388]

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** Resigned as Station Ichthyologist October 1, 1921.

THE RELATION OF FORESTS AND FORESTRY TO HUMAN WELFARE

"Forests are more than trees. They are rather land areas on which are associated various forms of plant and animal life. The forester must deal with all. Wild life is as essentially and legitimately a part of his care as are water, wood and forage. Forest administration should be planned with a view to realizing all possible benefits from the land areas handled. It should take account of their indirect value for recreation and health as well as their value for the production of salable material; and of their value for the production of meat, hides and furs of all kinds as well as for the production of wood and the protection of water supplies.

"Unquestionably the working out of a program of wild life protection which will give due weight to all the interests affected is a delicate task. It is impossible to harmonize the differences between the economic, the aesthetic, the sporting and the commercial viewpoint. Nevertheless, the practical difficulties are not so great as they appear on the surface."

HENRY S. GRAVES,

Former Chief Forester, U. S. Forest Service.

Recreation, Vol. 52, p. 236, 1915.

RESEARCH ON WILD LIFE

"The discovery of new species and races based upon the study of preserved specimens of game animals, has already progressed very far; but the more attractive field which includes the habits of the game remains yet to a great extent unexplored. This field is peculiarly open for investigation to big-game hunters, and to all other men who go far afield and obtain first-hand knowledge of the conditions under which the game animals live. The closet naturalist, with his technical knowledge of the structure of animals, can be trusted to perform the work of classification to a mathematical degree of precision; but we cannot obtain from him a trustworthy account of the behavior of animals in their natural environment, or learn from him the value to the animals of the various structures or characteristics which he has shown them to possess. Much knowledge regarding the habits of game is acquired by the successful sportsman. Yet it is often infinitesimal in quantity compared to what may be acquired if the outdoors observer will direct his investigations along the broad lines covering the life history of the species with which he comes in contact. To carry out such investigations successfully it would be necessary to spend many hours and days, perhaps even weeks and months, observing certain individuals or family groups of game. This is quite beyond the limits of time allotted the average sportsman. Nevertheless much can be learned by the collected evidence from many fragmentary observations providing only these are accurate. A great mass of accurate fragmentary observations will often spell far more progress in investigations of this kind than the observations of a few trained individuals over an extended period of time."

THEODORE ROOSEVELT and EDMUND HELLER.

Life Histories of African Game Animals,

Vol. I, pp. vii-viii, 1914.

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RELATION OF BIRDS TO FORESTS

"The total damage to trees by insect pests is enormous, and several years ago was estimated to exceed \$110,000,000 annually. Not only is the damage extremely large, but the difficulties of directly combating insect pests in forests are so great that man is able to do comparatively little. The services of natural enemies of the destructive insects should therefore be highly appreciated. If they serve to reduce the damage by only a small percentage, the gain to the country is a very large sum. Among these enemies, birds are conspicuous. Their services are well known and have long been acknowledged. No reasons have thus far developed for considering any other group of the natural enemies of forest insects in general, more important than birds."

W. L. McATEE,

American Forestry,

Vol. 21, pp. 681-682; 1915.

"Birds are not only essential to the welfare of the tree, but the tree is necessary to the life of the bird. Consequently, there has been established what is termed 'a balance of life' wherein there is the most delicate adjustment between the tree, the insect, the bird and the sum total of the conditions which go to make up their environment. * * * Birds are of value to the forest, however, not only as the destroyers of their insect foes, but the birds with the squirrels, help plant the forest by distributing seeds. The seeds which are encased in a pulpy covering, those of the berry or fruit-bearing trees, are voided unharmed by the birds often at a point far distant from the parent tree, the bird thus acting as their distributor. Acorns, beech-nuts, and chestnuts are frequently dropped or hidden by birds, and the seeds of pines are released and scattered by the birds that seek them in their cones. In short, we believe it can be clearly demonstrated that if we should lose our birds we should also lose our forests."

FRANK M. CHAPMAN,

*Seventh Report, N. Y. Forest, Fish and Game
Commission, pp. 117, 120; 1901*





PLATE 30. BIRDS OF THE ADIRONDACK HARDWOOD FOREST
 1, 2, Downy Woodpecker (male and female).
 3, 4, Hairy Woodpecker (male and female).
 5, Wood Pewee.
 6, 7, Scarlet Tanager (male and female).
 8, Red-eyed Vireo.
 9, 10, Black-throated Blue Warbler (male and female).

Drawn by Edmund J. Sawyer

RELATION OF SUMMER BIRDS TO THE WESTERN ADIRONDACK FOREST

By PERLEY M. SILLOWAY

CONTENTS

1. Introduction.
2. The Western Adirondack Forest Environment.
3. Habitat Preferences of Forest Birds near Cranberry Lake.
4. Influence of Certain Forest Trees on Bird Life.
5. Enemies of Adirondack Birds.
6. A Census of the Birds at Cranberry Lake.
7. A List, with Notes, of the Summer Birds about Cranberry Lake.
8. List of References.
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INTRODUCTION

The general purpose of the studies chronicled in these pages was to examine the interrelations between birds and the forest, that is, how the one influences the other, along the western border of the Adirondack Mountains. The scene of the investigation was at the permanent summer camp of the State College of Forestry at Barber Point on the south shore of Cranberry Lake, where the author spent the midsummer weeks in 1916. Two general aims were thus combined,—to gain a knowledge of the character of the local summer bird life, and to make a survey of its environment. The neighborhood of Barber Point was scanned carefully to distinguish local factors, or “minor habitats,” and the birds of each minor habitat were studied as a definite group of tenants, technically styled “avian association;” and both the number of species and the number of pairs breeding in each minor habitat, the sum of which measured the bird population of the district covered, were counted as closely as possible. A census properly made shows the standing of a district, in its ability to support birds, as compared with other districts, and is a basis for judging the value of the environment in any given case. Great difficulties were met with at this wilderness station in daily attempts to make a census; but I regard the result as fairly indicative of the quantity of bird life there, and also of the ecological preferences—that is, preferences as to surroundings—of the species in each association.

The general aspects of the forest in the western Adirondacks, where it is a uniform mixture of conifers and hardwood trees, with close undergrowth, are here first described in their relation to summer birds; and examples are given of how the minor habitats mentioned above naturally evolve, with the reasons why it is well to study

the subject by means of them. These limited, distinct features of the forest are ten in number; and each one, differing in some definable characteristic from the others, is taken up in order and described ecologically.

The general situation having thus been explained, attention is turned to the contributions made by the various trees, bushes, and vines of the region to the bird economy, with special reference to the food supplied by them. This chapter is especially to be noted as an attempt to make clear the wealth of subsistence furnished to birds by this forest, and the way it is utilized.

Following this part of the paper there is a general annotated list of the birds of the Cranberry Lake district, most of which were observed by the author during his stay at Barber Point. It is intended to enable not only students but interested visitors to become acquainted with the local bird fauna, by showing them where the various kinds may be looked for, and what are their songs, mating habits, and other peculiarities. Brief mention of the characteristic marks by which the different species may be identified will aid amateurs to recognize them.

I desire to express my sincere appreciation of the kindness extended to me by Dr. Charles C. Adams and former Dean Hugh P. Baker of the New York State College of Forestry, in their hearty cooperation with my ideas and methods of observation. To the Hon. R. M. Barnes, of Lacon, Illinois, special acknowledgment is due for his liberality in giving the assistance that rendered these studies possible. I wish to mention also my obligations to Prof. R. P. Prichard, Director of the Forestry Summer Camp in 1916, for his uniform courtesy in placing the camp facilities at my disposal, and to Mr. W. E. Sanderson, in charge of the camp commissariat; also to Dr. W. L. Bray, Dr. M. W. Blackman, Dr. L. H. Pennington, Prof. H. B. Waha, and Mr. Arthur S. Rhoads, for their courtesies in questions of identification of trees and plants and for other assistance. All of these have united to make my experience with them a season of profitable work and a pleasant memory. Finally I desire to acknowledge the assistance of Mr. Ernest Ingersoll and Professor Alvin G. Whitney in the final revising of the manuscript.

The authority used for the scientific names of the birds mentioned in this paper is the "A. O. U. Check-List of North American Birds," 1910, with revisions to date; and for the plants "Gray's New Manual of Botany," 1908. The brief descriptions of bird species in the annotated list are based chiefly on Hoffmann's "Guide to the Birds of New England and Eastern New York," 1904.

THE WESTERN ADIRONDACK FOREST ENVIRONMENT

Cranberry Lake is situated in the southeastern corner of St. Lawrence County, New York, among the western foothills of the Adirondack Mountains. It may be reached at the neighboring town of Wanakena by railway from Watertown, and also from the east by the New York Central Railroad to Childwold, and thence

by the Grasse River Railroad to Cranberry Lake village at its northern extremity. Service boats transport visitors to the various landings on its shores.

The Cranberry Lake district is typical of the western Adirondack region. The lake is surrounded by a forest that has been modified as elsewhere by lumbering operations and by fires; and it presents much variety, from patches of dense virgin timber to denuded hill-sides showing only bare rock slopes and exposed sand hills, while many burned areas blacken its shores. The lake has an elevation of 1,486 feet above sea level, and as the highest mountains in the vicinity are only slightly more than 2,300 feet in altitude, the forest there has that same uniformity of composition that characterizes the whole Adirondack region, except on the highest peaks.

This forest, the great "North Woods," is characteristically a mixed forest of conifers and hardwoods; and as it has reached its ultimate stage of adjustment, as to both the mutual relations of the trees and plants composing it and as to the physical environment, it is said to have attained its "climax." Although it has been greatly injured by the axe and by fire, its primitive character is still apparent.

It needs no argument to justify the conclusion that the nature and extent of these woodlands have determined the character and limitations of their avifauna, taking into consideration the general climate of the region. Safety in rearing their young, a minimum of danger from molestation by enemies, and retreats for protection and retirement, are requirements that render woodlands a vital necessity for the great majority of birds during the nesting season. Yet the situations most suitable are not in the vast stretches of forest solitude, but rather in broken woodlands where there are areas of illumination, streams or ponds, shrubbery for shelter and nesting places, and an ample food supply. With these advantages the Adirondack region is abundantly supplied, as well as with a variety of conditions sufficient to satisfy a wide range of bird habits and tastes.

The Adirondack mixed forest is composed of a few species of conifers and hardwoods, the two groups being represented in about equal proportions. The conifers are the balsam fir (*Abies balsamea*), red spruce (*Picea rubra*), black spruce (*Picea mariana*), white pine (*Pinus Strobus*),—also red pine (*Pinus resinosa*) on Cranberry Lake,—hemlock (*Tsuga canadensis*), and larch or tamarack (*Larix laricina*). The larch grows principally in boggy forests, but white cedar (*Thuja occidentalis*) is to be found where swamps prevail. The hemlock is associated chiefly with streamsides and lakeshores, or cool north slopes, where there is plenty of moisture combined with good drainage. The white pine abounds on sandy soils. The balsam and spruces are very generally distributed. The hardwoods include the sugar maple (*Acer saccharum*), beech (*Fagus americana*), paper or white birch (*Betula alba papyrifera*), and yellow birch (*Betula lutea*). There are no other prominent deciduous trees, although frequently the large-toothed aspen (*Popu-*

lus grandidentata) attains fair proportions along rocky lakeshores with the American aspen (*Populus tremuloides*), of slightly smaller size. Associated with the trees there is much undergrowth consisting of witch hobble (*Viburnum alnifolium*), cinnamon fern (*Osmunda cinnamomea*), seedlings and saplings of the parent trees in various stages of growth, and other elements.

Many stream valleys intersect the outer rim of the Adirondack plateau and converge like spokes of a wheel toward the "hub" of the region. These stream valleys form highways up which the more abundant and varied vegetation of the lower levels makes an ascent along the watercourses, thus creating lines of valley woodland reaching far into the forest characteristic of the high ridges and the central plateau. The invasion of this lowland vegetation inclines lowland birds which are fond of it and more or less dependent on it, to ascend the hills and mingle with the species that prefer the elevated evergreen woods. Thus the animal life of the region is as mixed as the forest, and any attempt to define zoological "zones" or take account of any influences of altitude (short of the high "alpine" peaks) is of little value. Whatever degrees of so-called Canadian character the fauna presents at 3,500 feet elevation, it also exhibits at 1,500 feet; and whatever degree of similarity to the Alleghanian fauna it shows at 1,500 feet elevation is also evident at 3,500 feet. These facts are amply demonstrated by comparing the list of birds resident in summer at Cranberry Lake with a list of those of the Mount Marcy region.

It is natural to ask why the 101 species of birds to be enumerated in Chapter 7 choose this region for their annual seasonal home. What are the local features that determine their preference? The desirability of the region appears to be found in the character of the widespread forest and its lesser vegetation, enhanced by the presence of a plentiful water supply in lake and streams, and the sunlit openings provided by swamps, bogs, burned areas and clearings. The summer temperature is favorable, the average temperature of a nesting site more or less exposed to the sun being about 85°F., while that in low bushes or on the ground, where nearly all birds build their homes, is only about 65°F.

The western Adirondack border in particular furnishes an adequate supply of food, both animal and vegetable, in the form of a vast variety of insects, seeds, berries, and other fruit. The virgin forest offers a less plentiful and varied bill of fare than the lowlands; but the effects of widespread lumbering operations in the region have been to create "burns" and clearings, where fruit-producing bushes and trees have grown in profusion, thus gradually extending the food supply attractive to the birds. Frequent openings in the heavy woods are therefore desirable, to give spots of illumination where shrubbery can thrive and bear its fruit. Summer camps and inns might be made more attractive, from the bird lover's viewpoint, by having near them a clearing for the natural growth of berry-producing shrubbery attractive to birds other than those of the surrounding virgin woods.

Another favorable circumstance is the scarcity of natural enemies, — animals that prove a terror to small birds in the nesting season, either by destroying the eggs and young in the nest or by destruction of the young while helpless soon after leaving the nest. Such enemies are now scarce in the Adirondack woods. Squirrels are not very abundant, the lumbering of conifers having tended to restrict their food. Harmful birds of prey, such as the Great Horned Owl, the Goshawk, Cooper's Hawk, and the Sharp-shinned Hawk, are comparatively scarce. Moreover, there is a dearth of other birds that molest smaller and weaker ones, such as the Bronzed Grackle, Cowbird, the Crow, Raven, Canada and Blue Jays and the Shrike. There is also an absence of snakes, such as the black-snake and the rattlesnake, the former of which especially is a dreaded enemy of birds nesting on the ground or in low bushes. The mammals that prey on nesting birds, but apparently are not common in the region, include the weasel, skunk, mink and marten. More numerous, however, are the white-footed mouse, chipmunk, red squirrel, and especially the raccoon.

HABITAT PREFERENCES OF FOREST BIRDS NEAR CRANBERRY LAKE

The Summer Camp of the State College of Forestry in 1916, as now, was located at Barber Point, near the mouth of Sucker Brook, on the southern shore of Cranberry Lake, New York. No public road reaches the locality, for it has no regular inhabitants; but it has been cut over for lumber and half-obliterated wood roads lead inland in various directions. The camp site is a level space of perhaps four acres, about twenty feet above the ordinary level of the lake, with a sandy soil, and extending back to the foot of a rocky ridge. The "campus" is clear of bushes, but a few large maples, beeches and birches have been left standing, and some white pines and aspens grow along the brink of the lake; while the eastern border is shielded by a fringe of mature trees and berry-bearing shrubs.

As my special purpose was to investigate the relations between the forest and its birds, and as I knew that certain birds belonged to one sort of place or set of conditions, and others to another, some preferring marshy spots, others uplands, some confining themselves to dense woodland and others to open sunny spaces, I thought it would be useful to discover what varieties of situation existed in this neighborhood; and having found them to study each in detail as to the conditions that seemed to attract their characteristic birds. After an examination of the neighborhood, I considered the following list of habitats worth separate treatment, as each seemed to present some peculiar attraction for certain birds and to exert particular influences upon them,—the birds in turn reacting on and tending to modify their forest surroundings. My field notes were therefore

separated so as to illustrate the ten different situations or "minor habitats," distinguished by local names, as follows:

- | | |
|------------------------|---------------------------|
| 1. Open Camp Site | 6. Bog, Open and Forested |
| 2. Partial Clearing | 7. Virgin Forest |
| 3. Habitation Clearing | 8. Lumbered Clearing |
| 4. Burned Tract | 9. Open Hardwood Forest |
| 5. Dry Grass Meadow | 10. Sucker Brook |

These will be considered in the above order.

1. The Open Camp Site. All the woodland birds may be seen or heard from the Camp, for their activities bring them in and out of the trees on the campus or surrounding it (figure 123), while the Bald Eagle and various waterfowl and shore birds, either residents or visitors to the lake, including the Great Blue Heron, Herring Gull, Loon and others, were added to the list from day to day. Kingfishers and Bank Swallows nested in burrows in the sand-banks along the shore. During the season of 1916 one or more pairs of Song Sparrows, Slate-colored Juncos, Cedar Waxwings, Red-eyed Vireos and Chipping Sparrows nested within the area of the Camp.

2. The Partial Clearing. Immediately back of the open camp space, occupying about the same area and of a similar character, is a fringe of open timber, undergrown with shrubbery, covering a rocky knollside. In early lumbering operations the conifers were removed, leaving tall maples, beeches and birches, among which are scattered a second growth of hardwoods and a few of the original conifers. The open places, littered with stumps, fallen trunks and débris, have been liberally overgrown with saplings and berry bushes, so that they virtually occupy all the illuminated space. The ridge makes a gradual ascent to the rim rock back of the Camp, attaining an elevation of about 330 feet at a distance of 600 feet from the edge of the campus. This clearing is the home of the birds that visit the campus, and it constitutes a distinct habitat in itself. It contains a running spring, from which water trickles under the bushes in a way to provide favorable bathing places; and in the course of the day most of the birds of the neighborhood may be observed at or near this spring, either feeding in the surrounding coverts or moving about in the trees scattered over the area. The following species are identified with this partial clearing as a nesting habitat: Bluebird, Robin, Chickadee, White-breasted Nuthatch, Brown Creeper, Catbird, Redstart, Maryland Yellow-throat, the Mourning, Chestnut-sided and Black-throated Blue Warblers, Red-eyed Vireo, Cedar Waxwing, Rose-breasted Grosbeak, Song Sparrow, Chipping Sparrow, Least and Alder Flycatchers, Wood Pewee, Yellow-bellied Sapsucker and Downy Woodpecker. The partial clearing thus affords an excellent illustration of the influences exerted by tall trees scattered over a clearing, in connection with suitable shrubbery as a covert, water facilities for bathing and drinking, a

nearby food supply, and open illuminated spaces to create a most desirable summer habitat for birds.

The most striking thing which such a clearing suggests is the influence of tall trees in an otherwise open area. The tops of such trees naturally receive the earliest illumination and warmth in the morning, and the latest at close of day; hence the most active songsters at dawn seek stations in trees to feed and sing, and from these sites they also chant in the lingering evening light (see Mousley, '19, '21). By visiting the tree-tops in the early morning, before the shrubbery and lower growth of the ravines and ground cover receive their first direct rays, the birds add materially to their hours for foraging and singing. It is supposable that day-flying insects are active as a rule in the tree-tops before those in the cooler and unlighted foliage below are stirring. The first spring warblings of the Bluebird are heard from the tops of tall trees. Robins recite their morning and evening choruses from commanding sites, and the evening songs of other Thrushes generally float down from the higher branches. The song of the Ruby-crowned Kinglet is a feature of the tall conifers, a burst of tuneful melody from illuminated spots in the woodland. The Red-breasted Nuthatch prefers to glean in the higher foliage. Many of the Warblers spend their time in the upper portions of the forest canopy, searching for their daily fare and uttering their short songs as they flit among the twigs in their quest. The Red-eyed Vireo loves the leafy screen of the taller hardwoods for singing and feeding. The Scarlet Tanager prefers the sunlight and warmth of the tree-tops, and the Rose-breasted Grosbeak seeks the highest stations for its full-voiced vernal song. The Pine Siskin and the Red Crossbill pursue their nervous activities in the tops of the dominant trees. The Crested Flycatcher usually finds a cavity in the upper story of the woods for its nesting site, as also do such woodpeckers as nest in the wilderness. Most of the rapacious birds build their nests in the tops of trees from which they can command a view of the neighborhood. Towering trees produce certain effects by their projection of dense shadows. On the middle story of the forest canopy and upon the ground cover their shadows lay a denser shade, augmenting the gloom that produces a twilight effect in the forest even at noonday,—a feature of the original woods that all birds avoid in favor of the sunny places. In the tops of trees, reaching upward to uninterrupted light, birds may be heard calling or singing as they seek their insect fare amid the burnished foliage, while below all seems silent and forsaken.

The effect of masses of light, as contrasted with prevailing shadow, is noticeable on the eastern shores of streams early in the morning, and on their western banks in the afternoon. When the sun is in the west, gloom envelops the wooded western banks of brooks and ponds, while their eastern margins still gleam in the flooding sunlight. Thus on opposite banks of even narrow streams diverse lighting affects the activities of the birds along their courses, much as do the sunny tops and shaded depths of a level forest. On the

other hand, the shadows of the taller trees may be grateful and advantageous to birds when cast over their coverts during the heated hours, producing cool retreats. Certainly a region lacking shaded coverts would not be tolerable for many of our summer birds, since it is customary for them to retire in the middle of the day into the cool shrubbery for a siesta. Few birds are heard in the hot noon hours, and fewer are seen. The woods are then silent and appear deserted, and it is an unpromising time to observe their winged inhabitants, whose slight movements are then limited to the low, shaded places. In an ordinary day in midsummer at Cranberry Lake, when a thermometer exposed to the sun registers 85° F., the mercury will fall to 65° when placed in shaded shrubbery. It is thus plain that the taller trees bring about circumstances that cause a series of adjustments in the daily life of the birds within their influence, leading them to regulate their movements so as to obtain favorable degrees of protection, light, temperature and subsistence. Whatever may be the value of light and shade as factors produced by tall trees in a habitat, any serious disturbance of the equilibrium resulting from their daily alternation must necessarily result in new adjustments of the birds to the changed conditions.

3. The Habitation Clearing. This term is used to designate an area of original woods from which the trees have been cleared by man to provide a site for buildings, a garden, sawmill or lumber camp. A clearing in this region is usually insignificant in extent compared with the surroundings, hence it is a secondary factor introduced by man into an avian habitat otherwise uniform. Any clearing, therefore, is an influence in the forest tending to restrict the dominance of certain birds and to enlarge the range of others. A habitation clearing, however, differs from an opening made by felling and removing the timber in that it projects into the locality certain influences, offering attractions and inducements that do not always follow the mere removal of trees. Buildings for the use of man and his domestic animals, with their accompaniments, serve as an influence to repel certain birds and to attract others. In addition, there are introduced into the clearing a number of foreign weeds and grasses, such as clover, timothy, blue grass, mustard and other seed-producing plants much patronized by birds as food, making the vegetation so different from the original woods that it constitutes a special habitat in itself.

Back of the Summer Camp a short distance, in an easterly direction, is the site of an abandoned lumber camp (figure 124). Ruins of log houses stand near the brook, and old trails lead thither. It contains no tall trees, so that its whole area is in full illumination; it has, however, several tall dead snags and boles, more or less fire-scarred (figure 125). Along the trails, and in open places where bushes have not established themselves, timothy, blue grass, clovers and other pasture grasses abound, with many of the weeds that thrive under cultivation. Interspersed everywhere in this clearing are elements of the aspen-fire cherry-birch association, with blackberry,



Fig. 123. Camp site at Barber Point, Cranberry Lake. The white and yellow birches here are favorite foraging grounds, during July and August, for Crossbills, Goldfinches and Purple Finches.

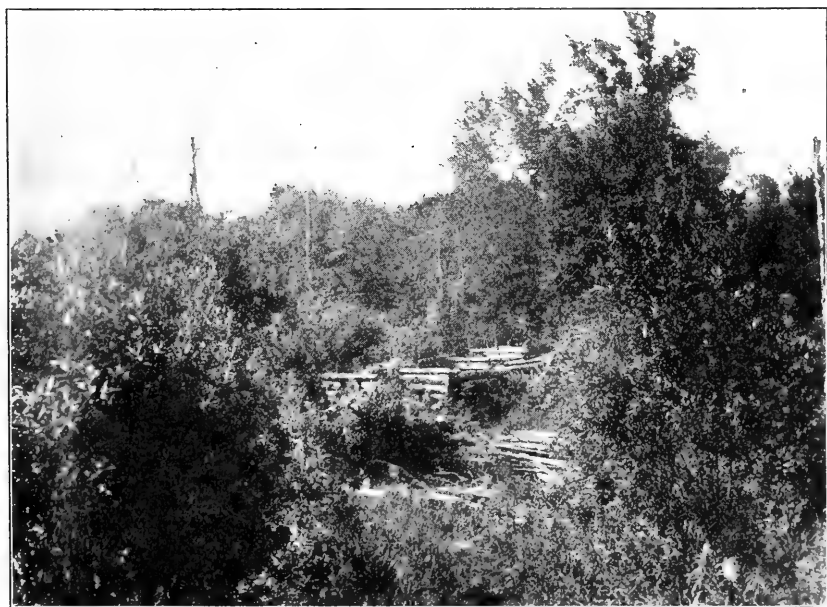


Fig. 124. Part of Habitation Clearing, showing abandoned log building and open area, the site of an old lumber camp, now a center of bird activity.



Fig. 125. A part of the Habitation Clearing, showing a dead yellow birch tree, a favorite haunt of Chickadees and Downy Woodpeckers. The fire cherry and aspens in the background harbor many birds, especially the Nashville Warbler.

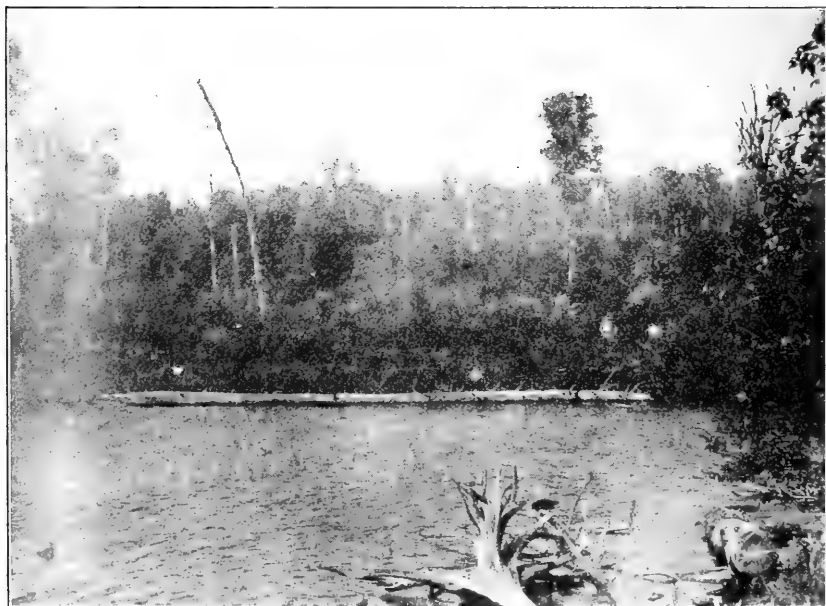


Fig. 126. The Burn, bordering Sucker Brook Inlet. Dense growth of shrubs and burned trees in front; unburned forest in background.

raspberry and other fruit-bearing shrubs of the region. Here the dearth of tall trees has restricted the number of species of birds, the absence of the Robin and some other familiar species being especially noticeable. The following species were found nesting here: Olive-backed Thrush, House Wren, Catbird, Redstart, Yellow-throat, Chestnut-sided and Nashville Warblers, Red-eyed Vireo, Cedar Waxwing, Rose-breasted Grosbeak, Song and White-throated Sparrows, Goldfinch, Least Flycatcher and Flicker. This clearing was freely visited by most of the birds of the neighborhood at various times in the season, for in midsummer it abounds with wild fruits; and it is likely that it was the most popular bird resort of all.

The general influence of clearings in a forested region on the local summer birds is well worth inquiry, as it produces a new order of ecological conditions. "By the ecological distribution of birds," says Dr. Charles C. Adams ('08, pp. 110, 122) "is meant that correlation between environmental conditions and the occurrence and association of certain species of birds. . . . Every field naturalist has observed the general correlation of certain birds with certain kinds of vegetation." He defines (l. c., p. 128) bird succession as "a change from the dominance of certain species or associations to that of others." Cary ('11, p. 34) shows that deforestation in high mountains in Colorado results in warmer local conditions, and consequently in an upward extension of the plant growth from below. Sunlight overspreads the ground, and the open spaces begin to present new forms of vegetation serviceable as cover and forage for insectivorous and fruit-eating birds. The occurrence of a greater variety of bird life in a clearing than in virgin forest is wholly in accordance with a fundamental law of ecological succession as given by Adams ('08, p. 125): "Where dominance obtains, avian variety is limited so that the greatest diversity occurs where local influences prevail, and at the margins of the formation." A clearing projects into the area of dominance a "margin," or a progressive series of "margins," productive of greater diversity than could be the case while the original forest held sway over the area. By this same law we account for the great variety of bird life in the Barber Point neighborhood, since it presents many local features of open campus, partial clearing, habitation clearing, burned tract, lumbered clearing, bog forest, meadow and dense forest, besides secondary factors of lakeshore and brookside. Each minor habitat or secondary factor creates a "margin" in the original forest, inducing the fullest diversity of species.

In the western Adirondack region, the clearings, where the soil is unaffected by fire, become quickly covered with berry-producing shrubs, including elderberry, blackberry, raspberry, blueberry and others, and the birds are more and more attracted to clearings as these fruits spread. Among the newcomers are Warblers, Sparrows and others that require a bushy covert. Furthermore, the shrubbery is prolific in insect food, and hence an additional influence is exerted upon the insectivorous birds to attract and hold them as tenants of the clearing.

Birds are inclined to maintain established spaces through which they can roam in singing and feeding without interference from others of their own kind. (See Mousley, '21, and Saunders, '14). When it is recalled that several broods of birds are reared in a small, definite habitat, it is a logical question to ask: Where are they to dispose themselves the next season, if all survive and the parents return to their former habitat? The new clearing partly solves the problem by affording increased space for birds nesting in the open; and this fact suggests an explanation of the phenomenon of the fairly constant numbers of individuals and species in any particular place. Many examples might be cited to show that birds adapted to their conditions immediately resort to new clearings. Orchards, especially those infested with canker worms or other insects, become a general rendezvous for the birds of the neighborhood. "Birds of the most varied character and habits," says Dr. S. A. Forbes ('82, p. 20), speaking of a certain orchard, "migrant and resident, of all sizes, from the tiny Wren to the Blue Jay, birds of the forest, garden and meadow, those of arboreal and those of terrestrial habit, were certainly either attracted or detained here by the bountiful supply of insect food, and were feeding freely upon the species most abundant." Many cases of this kind indicate that the prevalence of desirable insects, easy to be obtained, is a powerful influence in attracting birds, and that birds are led on this account to seek out clearings and natural openings in a forested region in order to take advantage of the abundance of suitable food.

4. The Burned Tract. I define as the "Burn" (figure 126) an area on the lakeshore east of the Camp, about half a mile in width, that was swept by fire in 1908. On its eastern side it merges into a bog partially forested, and along its southern side there is a dry meadow (figure 127). This burned tract is the center of the bird activities of the Barber Point neighborhood, for it presents features which are probably the chief factors in making that neighborhood a major avian habitat. Its aspect after eight years of new growth is that of the aspen-fire cherry-birch association (figure 128). It has no large living trees except in one small spot near its middle, where there is a group of tall hardwoods as relics of the original. Everywhere over the Burn are tall dead snags, boles and stumps, the remains of hardwoods evidently left by the lumbermen when the conifers were taken out. Later these trees were killed by the fires, and some of the trunks still remain standing, while the rest have fallen in a general tangle, difficult to travel through (figure 129). The drier parts of the burned land and its marginal aspect are well indicated in figure 130. F. M. Gaige ('14, p. 74) has explained the effects of such a burning on the local distribution of birds in northern Michigan. "It excluded," he tells us, "some species that must otherwise have been present, and favored the introduction of others by influencing food, nesting sites and enemies, and it affected the birds both in their breeding and migration seasons. Very interesting are the species favored by the Burn. They



Fig. 127. The Burn, bordering a meadow. The charred dead tree trunks are surrounded by a growth of young aspens, willows, low shrubs and meadow grasses. The hole in the stump in center of picture is the site of a House Wren's nest.



Fig. 128. Open margin of the Burn, with nesting site of Goldfinch in small birch tree. The vegetation includes fireweed, cinnamon fern, scattered fire cherry and clumps of aspen.



Fig. 129. A typical view in the Burn showing the re-occupation of the ground by a thick growth of shrubs and young trees, following a heavy fire of eight years ago. The character of the obstacles encountered in searching for birds' nests is here apparent.

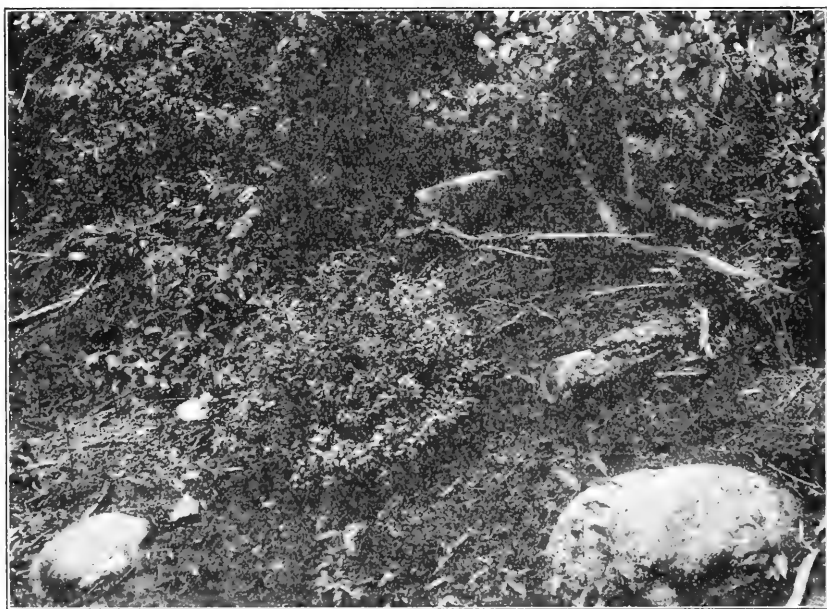


Fig. 130. A sunlit space at the edge of the Burn, showing a blueberry shrub in fruit, overhung by aspens and fire cherry. The blueberries are a favorite bird food.

fall directly into two classes, those furnished with suitable breeding conditions and those supplied with well provisioned halting places during migration." Among the species that found breeding places favored by the Burn, he mentions Woodpeckers, the Tree Swallow, Chimney Swift and Bluebird. Of the other breeding birds he says (l. c., p. 77): "To them the fire provided a long, new area of open land, much of which has since been covered to a greater or less degree with weeds and grasses. This permitted the birds to enter a region previously excluded from their range."

In its present aspect the Burn is dominated by aspens, fire cherry, birches, maples and willows, all in shrub or sapling stage and scattered in clumps over the area, with blackberry, raspberry, blueberry and tree seedlings forming a tangle wherever there are open spaces, and furnishing fruit and insect food in abundance (figures 131 and 132). As a further asset of this particular burn, there is plenty of water, as small rills trickle under humus-covered logs and rocks, forming shaded drinking and bathing places (figure 133). Among the birds frequenting the Burn, for nesting or foraging, are the Bluebird, Robin, Olive-backed Thrush, Chickadee, White-breasted Nuthatch, Winter Wren, House Wren, Catbird, Redstart, Canada Warbler, Maryland Yellow-throat, the Mourning, Chestnut-sided and Nashville Warblers, Cedar Waxwing, Scarlet Tanager, Rose-breasted Grosbeak, Song and White-throated Sparrows, Goldfinch, Purple Finch, Blue Jay, the Least, Olive-sided and Crested Flycatchers, Kingbird, Ruby-throated Hummingbird, Flicker, Sapsucker, Downy and Hairy Woodpeckers, Broad-winged Hawk and Canada Ruffed Grouse. Overhead, Chimney Swifts, Bank Swallows and Tree Swallows pursue their insect prey. Some of the typical birds of the Burn are illustrated in plate 31.

5. The Dry Grass Meadow. Sucker Brook, coming in from the east, constitutes an important secondary influence upon the bird life about Barber Point. About a half-mile up the brook is a level, dry meadow lying between the Burn and the brook, forming a special bird habitat about half a mile long and about ten rods wide (figure 134). Stumps here and there mark the site where timber had been removed in lumbering days (figure 135), and charred logs tell the usual tale of fire following the logging season. After the fire in 1908, owing to soil and moisture conditions, this tract became an open meadow. In 1915, to save the remainder of the neighborhood from threatened fire, this meadow was backfired, hence its aspect in 1916 represents but one season's growth. It is covered as a whole with coarse grass growing waist high, chiefly *Calamagrostis*, interspersed with which are berry bushes, occasional clumps of blue flag (*Iris versicolor*), and groups of speckled alder (*Alnus incana*), willows, aspens and others encroaching from the contiguous Burn. It thus appears that this meadow is passing into the shrub stage, the result of seeding in from the alder-birch-aspens association on one side, and from the alders along the brook on the other. Additional evidence of reforestation is seen in the young conifers spreading into the open area. Here and there stand

tall stumps and boles serviceable to many birds as perching and nesting places. The characteristic tenants of this meadow division were the Song Sparrow and Maryland Yellow-throat, they being the only residents truly associated with the grass cover. In the low shrubs and alders at the edges the Rusty Blackbird was sparingly represented. Cedar Waxwings nested in the sapling clumps, Chipping Sparrows utilized the shrubbery, and the House Wrens used convenient cavities made by Woodpeckers and Nuthatches in the dead stubs. No grass-inhabiting sparrows or upland meadow birds were seen there, and no Sparrow Hawk or Marsh Hawk; but other observers by keeping on the lookout may supply this unexpected deficiency in the list. It is interesting to note that this meadow, small as it is as a special habitat, serves to distinguish the preferences of the Red-winged Blackbird from those of the Rusty Blackbird; the former is found regularly on several floating bog islands off the lakeshore in the neighborhood, but not in this meadow, while the Rusty Blackbird is restricted to the meadow alone.

6. The Bog, Open and Forested. Immediately east of the Burn there is a remnant of forest constituting a bog. It was lumbered at an early day, and there are still standing several deformed specimens of the original conifers. The distinct character of this bog area, however, is indicated by the larch or tamarack (figure 136), not now found elsewhere in the Barber Point neighborhood except as an occasional sapling in some moist kettle-hole or depression. A few veteran stems of this species tower from the Bog, and there is a fair representation of saplings apparently fifteen or twenty years old. This Bog is formed by the drainage from one side of the Burn, and hence it sustains a typical sphagnum growth, with which are associated immature conifers left partially undisturbed by lumbering, and an occasional white pine (figure 137). There are the typical low shrubs, such as sheep laurel (*Kalmia angustifolia*), viburnum, service berry (*Amelanchier*), leather leaf, mountain holly, blueberry, red maple seedlings, snow-berry and dogwood; also the cinnamon fern and deer-hair sedge. Interspersed throughout the Bog are young white pines, balsam firs, red and black spruces, and tamaracks, with remnants of the former hardwoods. Sphagnum moss grows in a thick mass over the ground, covering holes between projecting roots and alongside boulders, covering fallen logs, and thriving above the sub-surface water holes. This Bog makes an abrupt transition from the Burn, constituting a minor habitat essentially different from any yet described, both in its bog characteristics and in its prevailing coniferous complexion. Also, a part of it is really open, supporting only low shrubs and young second growth; and it is fringed by a strip of virgin forest, to which it presents an abrupt contrast. In fact, the Bog lies between the Burn and Virgin Forest in such a way that there are presented three distinct minor habitats of interesting character, affording a good opportunity for direct comparison (figure 138).

Among the nesting birds of the Bog are the Veery, Brown Creeper, the Canada, Black-throated Green, Black-poll, Myrtle and



Fig. 131. The Burn, back of the Camp, showing dense shrub growth, with intermingled sapling trees. The home of White-throated Sparrows and Chestnut-sided Warblers.



Fig. 132. An area of the Burn, with nesting sites of Goldfinch (in birch sapling in middle foreground) and House Wren (in top of dead tree). This association includes fire cherry, maple, birch and aspen saplings. Mature forest in background.



Fig. 133. A small stream in the Burn, affording drinking and bathing places for the birds. A favorite haunt of the Chestnut-sided Warbler.



Fig. 134. Meadow along Sucker Brook. Note invasion of alders, making conditions particularly favorable to the Song Sparrow and Maryland Yellow-throat. Woodpeckers use the dead standing trees for nesting and foraging places.

Magnolia Warblers, Blue-headed Vireo, Cedar Waxwing, Lincoln's and White-throated Sparrows, Purple Finch, Blue Jay, the Alder, Yellow-bellied and Olive-sided Flycatchers, and the Arctic Three-toed, Downy and Hairy Woodpeckers (plate 32).

7. The Virgin Forest. Continuing eastward from the Camp up Sucker Brook, we reach a beginning of the heavy forest, which extends for several miles onward and includes the neighborhood of Curtis Pond, Irish Pond and Dog Pond, making an area of woodland as nearly original in its character as can be found in the western Adirondack region. This large timber begins about a mile from Camp and affords opportunity for comparisons of three secondary influences in the preferences of the birds for summer habitats,—namely, the Bog, the Meadow, and the Virgin Forest. The trees are conifers and hardwoods in about equal proportion, the former perhaps predominating. There are no bushes, the ground being shaded and generally overgrown with *Sphagnum* and wood sorrel (*Oxalis*), with a thin growth of seedlings from the parent trees. Within, it is dark, damp and silent. The birds to be seen in this dense forest are few. There is a minimum of light, and hence birds fond of sunshine are repelled. Other species avoid the dark forest because their mode of life associates them with scattered shrubbery or thickets. Here, however, the Hermit Thrush is to be seen at its best; the Golden-crowned Kinglet works in the middle story of the foliage, making its presence known by its impatient *see dee* often repeated; the Red-breasted Nuthatch regularly chooses this habitat; the Winter Wren utters its gushing song from the vicinity of brooks in this forest; the Black-throated Green Warbler and Black-poll Warbler occasionally disclose their presence by brief song or flutter of wing; at quarter-mile intervals the Red-eyed Vireo sings persistently; in the boulder-strewn ravines the Junco utters its monotonous rattle; and the Pine Siskin and Red Crossbill may occasionally be heard in the tops of the tall conifers. This list contains virtually all the birds frequenting the depths of a virgin forest here or elsewhere in the Adirondack region. (See plate 33.)

8. The Lumbered Clearing. South of the Camp, across Sucker Brook, lies an area of considerable importance in our bird quest, where the forest has been cleared by lumbermen some time ago. Unlike the Habitation Clearing, it has no buildings, or introduced forage grasses and weeds, and it therefore exhibits nature's methods of restoring injury when unaccompanied by human aid. The trees had been removed in the main, leaving the open area exposed to sunshine; and the prevailing vegetation is now berry-producing shrubbery grown breast high, and covering logs, stumps and small boulders, forming a tangle in the open spaces. There are also some tall deciduous trees, and several dead snags and holes. The birds of these clearings are much the same as those of the Habitation Clearing, excluding certain species especially attracted by buildings actually in use; and all sorts of birds visit it, as it borders the

lakeshore and affords good nesting places in some of the dead stubs and in the low thickets, and bears a profusion of fruit.

9. The Open Hardwood Forest. Besides the Lumbered Clearing across Sucker Brook, south of the Camp an area of dry open woods constitutes a habitat somewhat different from any yet described. Originally a part of the general forest, it was lumbered for conifers in an early day without greatly affecting the remainder of its tree life. Large shrubs or bushes are lacking, there is no tangle of ground cover and slash, and the ground is chiefly exposed, or covered with a layer of dead leaves. The floor plants consist of witch hobble, cinnamon fern and seedlings of the deciduous trees, maples largely predominating. These woods are not nearly so dark as was the original forest, since frequent openings were made by removing the conifers; neither is it damp nor moss-grown. Among its usual birds are the Golden-crowned Kinglet, Chickadee, White-breasted Nuthatch, Brown Creeper, Oven-bird, Black-throated Blue and Black and White Warblers, Blue-headed and Red-eyed Vireos, Scarlet Tanager, Wood Pewee, Crested Flycatcher, Flicker, Pileated Woodpecker, Yellow-bellied Sapsucker, and Downy and Hairy Woodpeckers (plate 30). These are active birds and their songs and call notes are more noticeable than in the darker woods.

10. Sucker Brook. Barber Point is formed by the intersection of Sucker Brook with the lakeshore (figure 139). The brook flows in from the east, the main stream averaging about twenty feet in width, and it is enclosed by trees and shrubs. Along the nearer portions of the Burn the brook tumbles over rocky shelves and boulders, but farther along, beside the Meadow it flows quietly through alders in a more level bed. It is obvious that the brook is not a habitat in itself; but as a secondary feature of the neighborhood it has an important influence. Its banks nourish the hemlocks; its shores, overhung with bushes, serve as coverts for shelter and bathing for the birds of the Burn and Clearing (figure 140), and its illuminated openings help diversify the surroundings. We find associated with the brook exclusively, only one bird, the Water-Thrush. If the brook were lacking this bird would probably not be present. Encroaching alders and fallen branches form pools (figure 141) near which is found the Water-Thrush, while Song Sparrows and White-throated Sparrows sing in the alders. Kingfishers nesting in the face of the sandbank at the Point make frequent excursions up the brook, and the Solitary Sandpiper shows a preference for its quiet pools. The Merganser, when its young are ready for the water, leads them up the brook for early lessons in the art of catching fish.

INFLUENCE OF CERTAIN FOREST TREES ON BIRD LIFE

To analyze more thoroughly the relations existing between birds and forests in the western Adirondacks, let us consider in detail each element of the Adirondack mixed woods, and the mutual influences exerted between them and particular species of birds. E. A.



Fig. 135. Meadow along Sucker Brook, bordering the dense, original forest. The stumps indicate the former character of area cut over. Ruffed Grouse, Hermit Thrushes and Olive-sided Flycatchers inhabit the evergreen forest.



Fig. 136. A Bog Conifer Clearing, showing typical bog shrubs, with tamarack saplings and dead tamaracks. Its open character makes this a favorite habitat for birds.

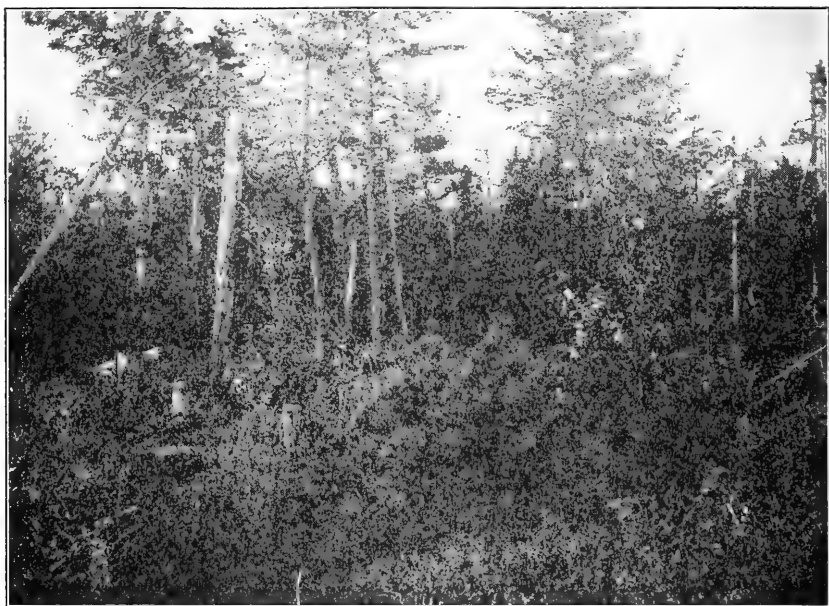


Fig. 137. A Bog Conifer area. The bog shrubs are interspersed with white pine on the slight elevations. A few broadleaf trees were left after lumbering. Favorite habitat of the White-throated Sparrow, Lincoln's Sparrow and Myrtle Warbler.

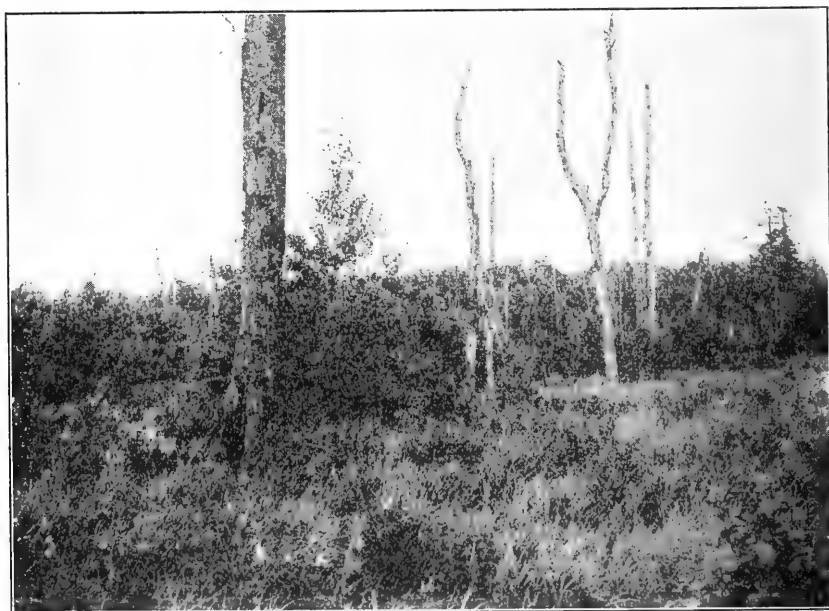


Fig. 138. Meadow Bog, at margin of dense conifer forest. Cleared bog forest at left, open meadow at right, and conifer forest in distance, furnishing three distinct habitats.

Sterling ('02, p. 18) suggests that we must look at a forest not as a mere collection of trees but as an organic whole, the result of actions and reactions among all the factors found within its limits. "The shade-enduring herbs and shrubs on the ground, the mosses and lichens on tree trunks and branches, and a host of other vegetable forms, are likewise a part of the forest whole, since they are products of and entirely dependent upon the natural forest conditions for their maintenance." It is in order that these complex and vital relationships may be more thoroughly understood that I present the estimates which follow, showing the relation between forest trees and the birds that frequent them. Dr. Frank M. Chapman ('03, p. 115) calls attention to their vital interdependence. "Certain forests have their natural insect foes to which they furnish food and shelter; and these insects, in turn, have their natural enemies among the birds, to which the trees also give a home. . . . Hence it follows that the existence of each one of these forms of life is dependent upon the existence of the other. Birds are not only essential to the welfare of the tree, but the tree is necessary to the life of the bird." We are clearly warranted, therefore, in believing that each kind of tree in the Adirondack mixed forest exerts an important and active influence in forming the association of birds belonging to the region; that certain birds are found there because certain kinds of trees or shrubs are dominant there, living not separately but in association. It is not the single birch tree that constitutes an attraction, but rather the birch as a participant throughout the Adirondack association that makes it effective upon the bird life in the region. For instance, the maple is a powerful agent in influencing bird life in an association; but I once knew a grove of forty acres of pure maple which did not attract a dozen species of birds in its summer prime. So also an extended area of nearly pure beech woods is almost a solitude in its expression of bird life; yet the beech, like the maple, is an invaluable constituent of the Adirondack forest.

There seems available only one method of estimating the proportional values of the relationships existing between any species of tree and the birds, and that is by a series of careful notes recording such relationships as are observed, and a general summary based on such data. It has been my method in bird study to make note of the kind of tree, shrub, or bush in which any bird under observation showed any activity of importance, either in locating its nest, searching for food, or selecting a favorite station for singing. For instance: "Dry Open Woods, July 7. Redstart's nest four feet up in a birch sapling in the periphery of a thick clump of birch saplings." Or: "Burn Lot, July 13. A male Chestnut-sided Warbler was gleaning insect food in a clump of fire cherry saplings and flying away with it, apparently to feed young." It is from multiplied records like these that the deductions and generalizations are made that follow in this report.

The Birch and the Birds. The white, paper, or canoe birch is found scattered throughout the Adirondack plateau, but tends to

fringe the shores of the lakes, streams and swamps at the lower levels. In the older woodlands the birch grows to a commanding height. Its fruit is a small, scaly, conelike catkin, which ripens in midsummer and clings to its place until late autumn. The yellow birch (*Betula lutea*) predominates in the forest farther back from waterlines, preferring dryer situations than its relative.

The small conelike catkin of the birch contains many flat seeds arranged along a stubby axis, which begin to ripen about the middle of July. Thereafter the birches receive visits from the Crossbills, which appear to know when the seeds are ready and frequent the trees irregularly as long as the supply of seeds lasts. During the last week of July the birch banquet is at its best, and at that time the crop on some trees in favored localities is thoroughly harvested. As a rule the calls of these birds can be heard when they are seeking the seed-bearing trees, but they are quite silent when feeding, or merely give utterance to a faint *quit*. In the season of 1916 four tall white birches were producing seeds on the campus at Barber Point. They bore plentifully, and I estimated that their crop sufficed for about three Crossbills a month, but other birds also visited them during that time and foraged there. Doubtless in many places the seed-bearing white birches were not visited so persistently and their seeds were permitted to remain until later in the season, forming a reserve supply. In the latter part of July Goldfinches, usually in pairs, also visit the birch trees for a part of their daily fare. On the ground under such a seed-bearing tree, can be seen in late summer the sprinkled small green scales of the catkins torn apart by the birds. Another visitor, later in the summer, is the Purple Finch. The birches also provide food for autumnal migrants and winter visitors. In describing the Red-poll in winter Dr. Mearns remarks ('80, p. 11) that "the swamps of birch trees that they inhabited, and on whose seeds they fed, were absolutely swarming with them. So great were their numbers that the supply of birch seeds soon gave out, and then they scattered over the entire region, feeding largely upon the seeds of the alder, and of various weeds." The same ornithologist also asserts that in winter the Goldfinch and the Tree Sparrow feed largely on birch seeds.

A very interesting relationship exists between the Yellow-bellied Sapsucker and the birches. The Sapsucker is a true woodpecker; but unlike its fellows it has developed a taste for sap and also the live inner bark, more especially that of the birch but also of most other forest trees. The Sapsucker drills a horizontal row of holes around a tree trunk, and later another row so arranged that one hole stands directly above another in the two series. From time to time additional openings are made in like manner, with the effect of vertical rows as well as horizontal, between which the sapwood becomes so injured that the tree is virtually girdled, or at least wounded in a way to induce premature decay. These holes, only deep enough to penetrate to the sapwood, become cavities in which sap accumulates in small drops, and the Sapsucker regularly visits

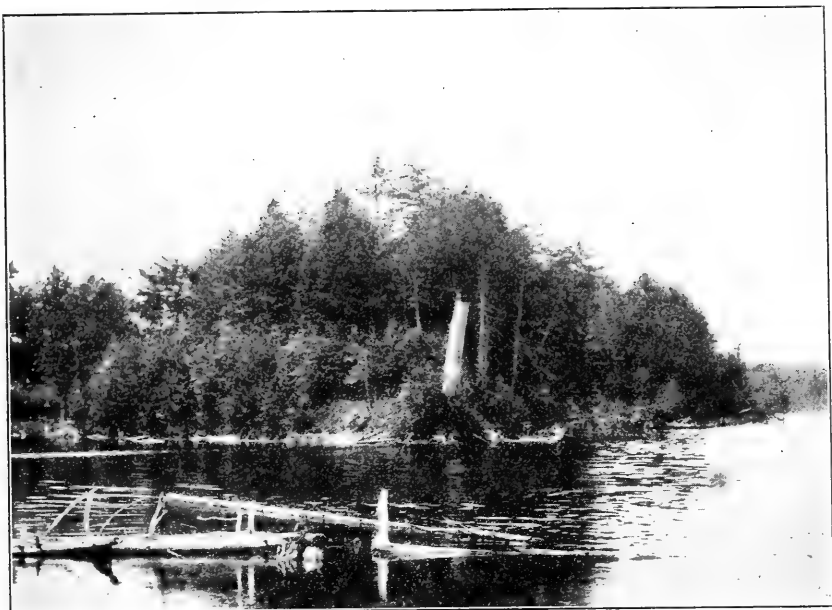


Fig. 139. Rocky shore of Sucker Brook Inlet, at Barber Point, showing character of mixed forest, mostly second growth saplings. Margin of lumbered clearing at left.



Fig. 140. View on Sucker Brook, showing tangle of vegetation along its banks. Dead birches at left, with living spruces beyond. A haunt of the Water-Thrush and Solitary Sandpiper.

them, spending much time in clinging to the trunk and alternately drinking the accumulating sap and enlarging the wells. A large tree thus affected will be frequented by several Sapsuckers very regularly in midsummer, and one or more juveniles may spend most of the day in such a tree. A family of Sapsuckers has several tapped trees within a convenient radius, and after the young are out of the nest their days are spent chiefly in loitering at one or another of them.

In estimating the apparently destructive effect of this habit of the Yellow-bellied Sapsucker we must consider the influence of the birches in the forest association, remembering that an undue proportion of any single element is likely to be as detrimental to the forest as is the lack of a certain species. As nearly as I could ascertain, at least six families of this woodpecker dwelt in the Barber Point neighborhood. No birch tree at the Camp had been materially injured. In the Partial Clearing four mature birches were regularly visited by Sapsuckers, and all showed old perforations, eight to fifteen feet above the ground, or higher. None of the four grew to full height, and none appeared to be bearing seed. The Sapsuckers were not making new holes in these trees, but were occasionally enlarging old perforations by chiseling into them and smoothing their edges. The one most persistently worked on was a tall, half-broken snag, with only a tuft of branches at its top, and this crippled remnant was the chief food resource for its Sapsucker family. I sought diligently for evidence of Sapsucker attacks on younger branches, but was unable to find any; and my conclusion is that these birds prefer to open old perforations rather than to make new ones. Most birches do not suffer seriously, and only a relatively small number of mature trees in a habitat are tapped at all. Frequently a Sapsucker will work industriously on the trunk of a mature birch for many minutes, seeking to extract a morsel of insect from its burrow, without any apparent intent of making perforations for sap. If even a small percentage of the attacked birches die, however, the Sapsucker thereby becomes an agency for the restriction of the species. It is certainly the cause of considerable local injury, but as the birch is a fairly constant constituent of the Adirondack mixed forest, and as the Sapsuckers' interrelations with it have long existed, there probably has come about a fair adjustment between the two. It is to be noted that the Yellow-bellied Sapsucker is not an inhabitant of dense woods, but rather of the forest margin, burns and open areas.

We are indebted to E. H. Forbush ('13, p. 122) for an account of the relation between the birds and the plant lice that infest the birch. "It is a widely known fact in Massachusetts," he records, "that practically all of the resident and migrant warblers eat the birch plant louse. It is only necessary for one to find a locality where these insects are numerous if he wishes to make sure of finding in their seasons about all the warblers that breed in that region or migrate through it, and also many other birds not ordinarily found

among the birches." His accompanying list enumerates 38 species of birds that feed on birch plant lice; and Forbush declares that undoubtedly the plant lice would considerably reduce the annual crop of birch wood and lumber were it not for the way in which their increase is checked by birds.

The following is a group of birds that I have noted as utilizing birches either as situations for nests or as the source of materials for their construction. The group may be designated as the birch-bark society, and is as follows: Red-breasted Nuthatch, Brown Creeper, Blue-headed Vireo, Pine Siskin, Redstart, Chickadee, White-breasted Nuthatch, the Bay-breasted, Parula, Myrtle, Magnolia, Black-throated Blue and Black-throated Green Warblers, Yellow-bellied Sapsucker, Downy Woodpecker, Red-tailed Hawk, Wood Thrush, Red-eyed and Warbling Vireos, Olive-backed Thrush, Sharp-shinned Hawk and Least Flycatcher. Birch saplings seem to be chosen in preference to any other kind of young tree as nesting places, especially by the Goldfinch, Cedar Waxwing and Olive-backed Thrush.

The Maple and the Birds. The sugar maple (*Acer saccharum*) is intimately associated with the birch and the beech, these together with the aspen, comprising the bulk of the Adirondack deciduous woods. Under ordinary conditions the maple grows tall and commanding, overtopping the other hardwoods and filling its allotted space with a spreading canopy of foliage. As a result of the extensive lumbering operations of the past, in which the conifers were removed, there are large areas where towering maples flourish. The small paired and winged fruits are developed in early spring, and are fine food for certain birds at a time when other vegetable fare is not yet available, as in the case of some species while they are moving northward, or are arriving in the early days of spring at their northern nesting habitat. The sugar maple does not rank with the white birch, however, since its seeds are produced at a time when such food is insignificant compared with the wealth of insect life then available; nor is the maple resorted to as much as the birch. The Rose-breasted Grosbeak, one of the finest songsters of the springtime and early summer, lives almost exclusively in the upper story of the maple and associated deciduous trees, and it then feeds extensively on the unfolding flower buds. Regarding this habit of the Grosbeak, we are justified in assuming that it is merely an agency by which the balance of nature is maintained, and hence the bird is not to be regarded as an injurious influence in the maple's life history. Our garden and shade trees are improved by culling the fruit buds early in the season so that the remainder may attain more perfect development in the fruiting period. The procedure is probably equally beneficial to forest trees, as the birds that feed upon their flower buds doubtless exert a "thinning out" influence that results in the production of more energetic seeds. The Purple Finch also eats maple blossoms frequently.

Maples offer convenient nesting places not only in the wilderness but in village streets and public parks. Here in the woods the Robin and other thrushes frequently lodge their nests on a maple's stout limbs. The Alder Flycatcher and the Wood Pewee choose its bare forks, and the Crested Flycatcher finds high natural cavities in aged trunks as suitable places to rear its broods. The Cedar Waxwing and Scarlet Tanager construct nests in the maple's shady canopy, and Vireos very commonly use a drooping fork in the lower outer twigs as a support for their pendent homes. As a foraging place and as a song station, the value of the maple is inestimable, for I find it to be patronized by a large proportion of the song and insectivorous birds of any neighborhood.

In its sapling stage, as a part of the aspen-fire cherry-birch association, there are found with the sugar maple the red maple (*Acer rubrum*), the striped maple or moosewood (*Acer pennsylvanicum*) and the mountain maple (*Acer spicatum*). These have much the same characteristics in burns and clearings, and all are favorites with birds. The Olive-backed Thrush nests in the upright crotches of a maple more often than elsewhere; and as a gleaning ground and quiet retreat for rest the young maple is probably of greater service than any other tree in its community.

The Beech and the Birds. The beech grows with a uniform cylindrical stem, and where the conifers have been cut away it spreads a spacious leaf canopy. Frequently, beeches equal the maples in height, especially along old sandy stream beds, although as a rule the maples surpass the beeches in bulk of trunk and extent of lateral branches. Both show the effect of early growth in close company with other trees, by their tall unbranched trunks and an abrupt spreading at the top, while the birches begin to send out short lateral branches farther down on the trunk and produce a spindle-shaped tapering mass of foliage. The fruit of the beech is a small bur containing two triangular nuts that ripen in late summer. The fruit clings to the stem after ripening, and often remains on the tree as an available food supply for animals during the winter.

For the purposes of the birds the beech ranks next to the sugar maple in value. The Robin, Tanager, Grosbeak and other singers avail themselves of its high twigs for their morning and evening recitals. The Kinglets, Chickadees, and Nuthatches glean from its trunk and branches for their insect fare; Warblers hunt for insects amid its foliage; the Red-eyed Vireo sings as it works among the leaves, and the Cedar Waxwing nests in a fork of its branches. In winter the Blue Jay harvests its food from its laden twigs, and woodpeckers drill through its bark for hidden beetles and larvae. As the maple is perhaps the more popular with the birds in the spring, so the beech is preferred in the fall because of its store of ripening fruit. The beech thus supplements the maple, and its flower buds are also a spring dainty to the Rose-breasted Grosbeak.

Dr. B. H. Warren found flowers of hickory in 11 Grosbeak stomachs, those of beech in 26, maple in 3, and other blossoms in 23 stomachs collected during May in Pennsylvania. McAtee ('08, p. 39) notes that no appreciable damage ensues from the bird's habit of feeding on the flowers of forest trees, since the fruits of these trees are of little economic value. "Moreover, it is noticeable that the fruit-producing or pistillate flowers are not the ones preferred, but the sterile staminate ones. These are produced in countless millions, and wither and fall away after a short season."

It is in autumn that the beech becomes really valuable to birds, for it produces the only nut fruit available in the Adirondack region; hence in the fall it attracts a class of feathered residents that otherwise might not be present at that time. White-breasted Nuthatches, Red-headed Woodpeckers, the Bronzed Grackle, Crow, Flicker, Wood Duck and Blue Jay eat them;—in fact, beech nuts in the absence of acorns, must serve as the main support of Blue Jays in the Adirondacks during the fall and winter. Approximately three-fourths of the annual food supply of the Blue Jay is vegetable matter, the greater part of which is mast. Merriam ('78, p. 124) reports that Red-headed Woodpeckers subsist almost exclusively on beech nuts, both green and ripened. "It is truly a beautiful sight," he exclaims, "to watch these magnificent birds, together with their equally abundant cousins, the Yellow-bellied Woodpeckers, creeping about after the manner of the Warblers among the small branches and twigs which bend low with their weight while picking and husking the tender nuts." Mrs. Fanny Eckstorm ('01, p. 57) reports that in Maine the Red-heads not only eat beech nuts in the fall, but store them up for the coming winter; and she adds the Downy and Hairy Woodpeckers to the list.

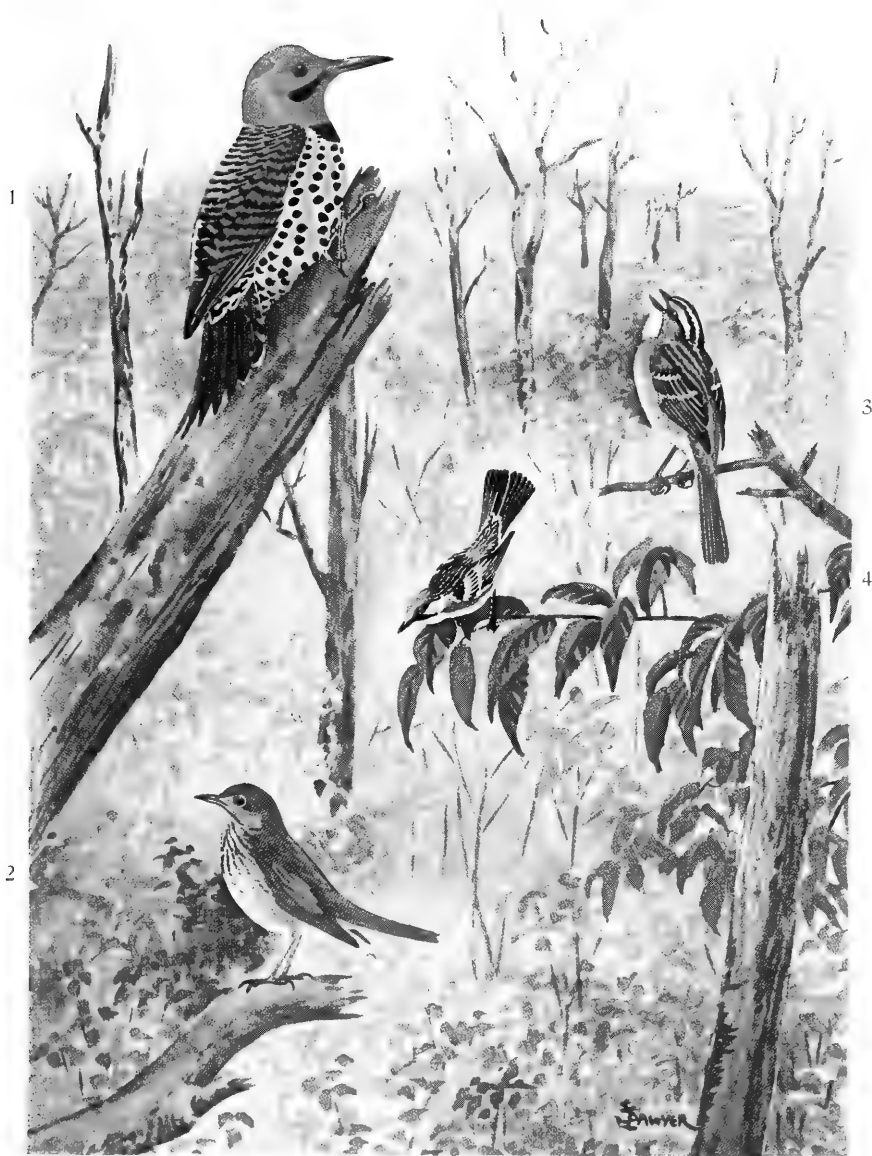
The Hemlock and the Birds. The hemlock is a handsome tree in its maturity, although usually less tall than the remaining pines. Originally it flourished extensively throughout the Adirondacks, but in the lumbered regions has practically disappeared except in the present second growth. It has an advantage in relation to its benefit to birds in its preference for streamsides and moist cool ravines, where birds naturally congregate because food is most abundant there, as well as good bathing places. Among those partial to the hemlocks are the Kinglets, Red-breasted Nuthatch, Chickadee, Winter Wren, about all the local Warblers, the Junco, Pine Siskin, Goldfinch, Purple Finch, Canada Jay and the two species of Crossbill.

The fruit of the hemlock is a small cone, usually less than an inch long, with thin, persistent scales, and matures the first year. In late summer the seeds begin to ripen, and thenceforth the hemlock is regularly resorted to by such birds as feed on conifer seeds in general, most of them winter residents. Dr. Mearns says in his "Birds of the Hudson Highlands" ('79, p. 204): "I used frequently to visit a certain dense grove of hemlocks, that was constantly inhabited by large flocks of Crossbills of both species, for the purpose of watching their singular habits. The White-wings

were somewhat shy and suspicious, and extremely restless, constantly flying from the top of one tree to another, and keeping up an incessant rattling cry; but the Red Crossbills were found in larger numbers frequenting the lower drooping branches, to which they clung in every variety of posture, gleaning busily the while, seldom roving about, and inclined to be noisy and chattering, though their notes are very unlike those of the other species, and more nearly resemble those of the European Sparrow. Their dexterity in extracting the seeds from cones is quite remarkable, and the shower of refuse materials sent down from a tree-top, is, of itself, sufficient to apprise one of their presence." Mearns also saw flocks of Purple Finches in March eating hemlock seeds, and the Pine Grosbeak, Pine Siskin and Goldfinch living on them largely in winter. Sapsuckers do not attack the hemlock as seriously as they do the birch, and their punctures do not produce such lasting injury as they do to hardwood trees.

The Spruces and the Birds. Two spruces belong to the Adirondack mixed forest, the red spruce (*Picea rubra*) and the black or bog spruce (*Picea mariana*). They are almost indistinguishable in certain periods of their growth, and are practically alike in their relationship to the birds. These spruces produce small pendulous cones with thin scales, which mature in one season and retain their conical form until they drop from the trees. Like other conifers, they yield a bountiful supply in some years while in others very few seeds are borne. The spruce has been nearly eliminated in many cut-over areas. Its birds are much the same as those seen about hemlocks. As a nesting site the spruce is not a general favorite. The Black-poll Warbler frequently makes its home in a small spruce, as do also the Magnolia Warbler, Myrtle Warbler, Chipping Sparrow, Cedar-bird and Purple Finch; and the Ruffed Grouse and Canada Spruce Partridge occasionally place their nests beneath its low, drooping boughs.

Certain of the birds above mentioned spend considerable time hunting for insects in the spruces, searching them little by little and flitting among their branches and twigs with diligent persistence. A small grove will furnish plenty of material for the foraging of a Myrtle Warbler or a Black-poll for several days. In fact, spruces seem to be more attractive for their insect supply than for their seeds, and most of the small birds resort to them. It is remarkable how many food morsels can be found by birds in a patch of spruces. A family of Kinglets will spend many minutes in getting a dinner there. As I consider this phase of my observations, I am led to note the significance of the fixed and definite associations that mark the relations of birds to their surroundings. Certain birds of a neighborhood quite regularly haunt the spruces, or the hemlocks, or the birches, or the maples. Why is this the case? Again, there are certain birds that we do not look for in the spruces, or the hemlock, or the birches, or the maple; but why are they not found in such associations? It would be quite irregular to find a Bluebird



Drawn by Edmund J. Sawyer

PLATE 31. BIRDS OF THE ADIRONDACK BURNED FORESTS

1, Flicker.

2, Olive-backed Thrush.

3, White-throated Sparrow.

4, Chestnut-sided Warbler.

gleaning from a spruce tree,—or a House Wren, or a Catbird, or a Rose-breasted Grosbeak, or a Rusty Blackbird, or a Wood Pewee.

In reviewing the records of observers in eastern Canada and in northern Maine it becomes evident that the spruce is there more commonly utilized than here as a nesting place, and its needles as nesting materials. The Magnolia Warbler especially seems to prefer this kind of tree for its home, and Gerald Thayer thinks that "Spruce Warbler" would be an appropriate name for it, quite as appropriate as "Birch Warbler" for the Nashville. "The Magnolia keeps to the spruces (and other conifers) at least as strictly as the Nashville keeps to the birches (and other broad-leaf trees). The feeding range or 'beat' of this Warbler in its chosen summer woodlands about Monadnock, lies between the tip-tops of second growth spruce trees and their lowest branches. Although not shy, it is apt to stick rather closely to the inner recesses of spruce clumps, less often showing itself on the outermost twigs than do the Blackburnian and Black-throated Green." The same might be said of the habits of the Black-poll Warbler in the same locality and northward.

The spruces are commonly infested with bark beetles and wood-boring beetles. I am reminded of a statement by McAtee ('15, p. 862) that the birds in general destroy large numbers of the bark beetles that are among the worst pests of our forests. "They feed just beneath the bark, forming tunnels which in many cases girdle and thus kill the trees." He asserts that "The spruce-destroying bark beetle has been responsible for the loss of many billions of feet of timber in the northeastern United States," and quotes Dr. A. D. Hopkins, of the United States Bureau of Entomology, in giving birds the credit for devouring this beetle, as follows: "The principal enemy of the spruce-destroying beetle, and other bark-infesting enemies of the spruce, consists of the Woodpeckers, which destroy, it is believed, from 50 to 75 per cent of the broods of the spruce-beetle in many hundreds of trees each year."

The Balsam Fir and the Birds. The fir (*Abies balsamea*) grows in the virgin woods in a tall, symmetrical form, sending upward a slender conical spire that pierces the surrounding canopy in marked contrast to the clustered foliage of the deciduous trees associated with it. Its distribution is general on the Adirondack forested plateau, and, like the spruce, in localities lumbered in an early day it has commonly reproduced itself by a vigorous second growth. This fir produces medium-sized cones that stand erect on the upper side of the branches. They reach maturity in the fall, and the seeds become a staple article of food for the birds in late autumn and winter. This tree ranks high as a favorite in the mixed forest in the several uses made of it by the birds, and it is probably visited by larger numbers in the course of a season than any other conifer. Birds freely select the fir for nesting sites, constantly search it for insects, and resort to it for protection and seclusion. The Cross-bills are characteristic birds of the balsam, eating its buds in the

spring and its seeds in the fall and winter. The movements and activities of the Crossbills are governed largely by the forest's supply of cones, hence these birds rove about much in quest of food, visiting the seed-bearing trees as they find supplies here and there to claim their attention. At their repasts in the balsams and other conifers the Crossbills detach many cones and also loosen many seeds which fall to the ground uninjured and later germinate. These birds, therefore, are agents in the distribution of conifers throughout the region. Besides the Crossbills, the Canada Spruce Partridge eats balsam buds in the spring; and it often makes its nest under fir trees, in the shelter of their low-drooping branches, as also does the Ruffed Grouse. The Olive-backed Thrush characteristically selects the fir as a situation for its nest, placing it on a horizontal branch against the main stem at a point about two-thirds the way up the tree. The Golden-crowned Kinglet commonly constructs its globular nest there, and the Cedar Waxwing often builds in the fork of a scraggy limb. The Chipping Sparrow, Pine Siskin, Crossbill, Purple Finch, Blue Jay and Canada Jay are also among Adirondack birds that freely nest in the fir, as do also various Flycatchers, Warblers, Woodpeckers, Nuthatches, Creepers, and even the Hummingbird and Sharp-shinned Hawk. I have found an equally long list of birds that make their homes among the branches of fir trees in northern Montana.

The White Pine and the Birds. In the original forest the white pine (*Pinus Strobus*) towered aloft in strength and dignity as the most important element of the mixed woods of the Adirondack region, and in the remaining areas of virgin timber the white pine is still a dominant figure. It is scattered quite generally throughout the Adirondack plateau, but thrives best on the sandy levels and in the valleys of ancient lakes and glacial stream beds. On extensive sandy areas as in the Champlain-Hudson drainage, it flourishes almost to the exclusion of other trees, making such a large proportion of the timber that it appears to be a pure stand. The seeds of the white pine are produced in long cylindrical cones that are found scattered about under the trees after they have opened and distributed their seed in the winds. The white pine is not as popular with birds as are other conifers. It is very unusual to find a nest in a young pine, its habit of growth in open situations perhaps making it rather too conspicuous for nesting sites, and its foliage affording little concealment. A small group of birds do resort to the white pine in summer, among them Kinglets, Chickadees, Nuthatches, Vireos, Brown Creepers, the Pine, Black-throated Green, Blackburnian and Myrtle Warblers, Pine Siskins, Crossbills, Pileated and Three-toed Woodpeckers, and the Broad-winged, Red-shouldered, Red-tailed and Fish Hawks. The larger birds of prey find the loftier pines excellent for nesting and for vantage points from which to survey the landscape. The list might be extended if one were to add all the birds that put its long needle-like leaves into the structure of their nests, or glean among its resinous branches, forming altogether an ecological group of great interest.

As the scales of the pine cones are large and stiff, only the larger of the winter seed-eating birds feed upon their seeds to any extent. Chapman ('97, p. 196) says of the Crossbills that "they feed almost entirely upon the seeds of pines." It has been my observation, however, that the Crossbills seek the seeds of the tamarack and fir in preference to those of the pine, though this may be explained by the great irregularity of the pine in the production of its seed. It has been asserted that the white pine can be relied upon to produce a crop only once in five or six years.

In forest nurseries, ground-feeding Sparrows, including the White-throated Sparrow, commonly destroy numbers of white pine seedlings as soon as they appear above the ground, eating the tender cotyledon leaves. Whether they do similar damage in the forest under natural conditions is a question.

Among the birds attracted to the white pine in search of certain insects, Forbush ('13, p. 161) mentions the Golden-crowned Kinglet as feeding on the eggs of the white pine louse; also that the Chickadee and the Downy Woodpecker kill many white pine weevils (*Pissodes strobi*) and their larvae which are very destructive to the tender leading shoots of young trees. Dr. Beal ('06, p. 245) informs us that about thirty-five species of the cerambycid and buprestid beetles feed on the pine tree; and shows that the Downy, the Hairy, and the Three-toed Woodpecker prey upon the larvae of these very destructive borers. If this tree was otherwise more attractive to birds it is probable that it would not suffer as severely as it does from insect attack.

The Tamarack and the Birds. Prominent in the swampy parts of the forest is the larch or tamarack (*Larix laricina*). Where undisturbed, it grows to a stately height, sending its slender spire far above its surroundings, and terminating in a symmetrical cone of foliage. It stands chiefly in bogs and at the edge of swamps and meadows, where its slender light-green foliage gives a pleasing variety among other darker conifers. It produces small cones, whose seeds are a staple food supply for seed-eating tenants of the forest, but it is irregular in yield. While not so much used for nesting sites as the other conifers, it is a favorite foraging ground for insectivorous birds. A well-developed, mature tamarack towering perhaps to a height of 100 feet, will include several clearly defined zones of bird activity. A Woodpecker may be working diligently on the lower portion of the trunk, a troop of Chickadees or Nuthatches or Kinglets at the same time gleaning industriously in the foliage a few feet above, and Crossbills or Pine Siskins feeding on the seeds near its top.

The Alder and the Birds. The speckled or hoary alder (*Alnus incana*) is met with wherever streams meander sluggishly through level territory, their banks clothed in a spreading tangle ten or twelve feet in height. Its fruit is a small scaly cone like that of the birch, which clings to its place on the branch throughout the winter. The alders form a cover for hordes of water insects,—mosquitoes, flies and the like,—and all the insect-catching birds resort to its



Fig. 141. A pool on lower part of Sucker Brook, formed by encroaching alders and fallen branches. Song Sparrows and White-throated Sparrows are commonly singing in the alder thickets, and the pool is the home of the Water-Thrush.

thickets. Rusty Blackbirds, after their young are on the wing, spend a great portion of the day there, where attractive food can be had for the taking, and remain until they migrate southward in the autumn.

The Aspens and the Birds. The American aspen (*Populus tremuloides*) and the large-toothed aspen (*Populus grandidentata*) occur both in company and separately. In most of the Adirondack region they are found chiefly in the sapling stage as components of an aspen-fire cherry-birch association on burned areas. Along rocky shores both aspens may attain a height of 50 or 60 feet. Their seeds ripen and fall to the ground early in the spring and apparently are not eaten by birds. The chief function of the aspens is to afford a cover or screen for other trees more favored as nesting sites. A birch, willow or maple sapling, growing amid aspens, is a common nesting place, chosen apparently because so well hidden. As a screen for the fire cherry, on whose fruit most of the birds of the Burn feed freely during its prime, the aspens play a very useful part, for without their shelter the cherry would be less freely patronized, especially by some of its visitors, notably the Thrushes and others of a retiring disposition. Young aspens are often attacked by the Sapsucker, which drills through the bark usually just below the lowest branches of the trees. Such perfora-

tions are made apparently by juvenile birds in late summer, and in many cases the aspens immediately begin to show signs of sickness and die in the fall.

The Fire Cherry and the Birds. The most characteristic element of the cleared and burned tracts, especially where dry, is the fire cherry or bird cherry (*Prunus pennsylvanica*). It is chiefly associated with the aspens, birches, maples and willows, all in the sapling stages. The fire cherry grows in clumps, and at its best in the western Adirondack region may become ten to fifteen feet in height. It forms no part of the original dense woods, but follows the clearing of the forest, particularly in openings that have been swept by fire. It produces a small red fruit, the fleshy part of which is thin and sour, in clusters that begin to ripen by the end of the third week of July; and for the following month or so these natural cherry orchards are favorite resorts for birds. After the middle of August, heavy rains are likely to beat off the fruit. It appears that the fire cherry is the most important source of summer bird food in the Adirondacks, as it is also a good foraging ground for the insect hunters.

The Mountain Ash and the Birds. This tree (*Pyrus americana*) does not usually attain more than the tall sapling stage. It grows best along the rocky shores of lakes, ponds and streams, or on the edges of bogs and swamps. It produces small berry-like fruit, in showy clusters ripening in the fall and remaining in place as a late autumn supply for various species of resident and migrating birds after the summer fruits have served their turn. Some birds leave their summer habitat as soon as their young are fairly well able to care for themselves, while others linger as long as there is suitable food and the weather not too severe. With the latter group the mountain ash berries are an important food, and also with such migrating birds as travel southward in a leisurely way, enjoying the bounties of nature as they go. These berries are the principal fare of Robins in the fall, but the supply is soon exhausted, as the birds are loath to leave a locality where there is an abundance of the fruit. The Catbird until late in the fall also skulks among the coverts where mountain ash berries abound. Eaton ('14, p. 10) tells us that a crop of mountain ash berries attracts flocks of Cedar Waxwings and Pine Grosbeaks; and that the Purple Finch shows a preference for these fruits in winter. This tree is one of many species tapped by the Yellow-bellied Sapsucker for its sap.

From this brief sketch it appears that each species of forest tree exerts its own particular influence upon bird life; and to some degree each component of a vegetation association is effective in attracting one or another of the group of birds recognized to be closely related to it. One element alone, as a pure stand of beech or a grove of maples, exerts but slight influence on bird life; but such an element combined with others may become an influence of vital importance.

ENEMIES OF ADIRONDACK BIRDS

Predatory Mammals. In the foregoing pages I have presented the favorable features of the western Adirondack forest as a summer habitat for birds. The North Woods was originally tenanted by predacious animals of many kinds which preyed on their weaker neighbors and among them were numerous species of birds. Most of these have been so thoroughly killed off and driven away that they are no longer a serious menace in the Adirondack woods, but some few remain. Wildcats, foxes, skunks, weasels, martens, squirrels, mice, snakes, hawks, owls, Crows, Jays and Cowbirds all destroy birds or their nestlings, but happily none of these is numerous in the Adirondacks, and some of them are so rare as to be negligible at least in the western area.

Men and boys, directly and indirectly, do more harm, perhaps, than any other bird enemy,—directly by shooting and by robbery of nests, and indirectly by destroying through their “improvements,” favorable and habitual haunts. The two carnivorous animals they bring with them—the dog and the cat—add a new and destructive feature to the predatory side of nature. Dogs undoubtedly find and eat the eggs of ground-nesting birds, and disturb them grievously when they do not rob them. Far worse than this, however, is the marauding house cat, now undoubtedly the worst enemy against which birds making homes anywhere near civilization have to contend. In the latter part of summer two kittens were brought to Barber Point and installed in the Camp kitchen. They at once began depredations upon the young birds just leaving their nests, and thereafter took one, two or three every day. Inasmuch as the cat is an introduced enemy of the birds, its ravages are more severe than those of natural enemies, particularly in the nesting season when birds are practically helpless against its craftiness.

The red squirrel, next to the house cat, is regarded by naturalists as the predator most harmful to birds. Dr. Merriam states ('86, p. 215): “The propensity to suck the eggs and destroy the young of our smaller birds is the worst trait of the red squirrel, and is in itself sufficient reason for his extermination, at least about the habitations of man. I have myself known him to rob the nests of the Red-eyed Vireo, Chipping Sparrow, Robin, Wilson's Thrush, and Ruffed Grouse, and doubt not that thousands of eggs are annually sacrificed, in the Adirondack region alone, to gratify this appetite. Therefore, when abundant, as he always is during the springs that follow good nut years, his influence in checking the increase of our insectivorous birds can hardly be overestimated.” Fortunately, this excitable little marauder is ordinarily not very numerous at Cranberry Lake, but its numbers vary from year to year. (Cf. Thoms. Bird Lore, Vol. 24, pp. 206–207, 1922.)

The Adirondack plateau forests lacks oaks, hickories, walnuts and chestnuts, hence the larger squirrels can not find the staple articles of their regular fare in this region. The beech is the only mast-producing tree. Where conifers abound, the red squirrel can ob-

tain an abundant supply of cones; but in extensive lumbered areas, the mature, seed-bearing conifers have been nearly eliminated, so that the food supply of the red squirrel there has been much reduced and its range has been restricted to patches of virgin timber. About Cranberry Lake this squirrel shows a preference for seeds of the tamarack and the fir, and where these are scarce it must depend mainly on beech nuts. It is only where beeches grow that the red squirrel is found in the open woods.

The chipmunk is also accused of robbing birds' nests, but its forays seem to be rather an occasional yielding to temptation than a persistent habit.

Undoubtedly all the small carnivores avail themselves of any chance to get a meal of birds' flesh or eggs; but they are few here. Weasels alone remain numerous, and these sly, lithe creatures, able to make a quick pounce on a sitting bird, to climb the larger trees, and to worm their way into hiding places, are inveterate nest robbers. Weasels doubtless destroy scores of bird families every season, attacking even Grouse. To a less extent the fox, lynx, mink, skunk and raccoon are foes of birds, especially game birds and others that make their homes on the ground. Observers differ as to the mischief done by the raccoon. It is one of the commonest mammals of the Cranberry Lake district,—three were caught in one night at the Camp in a figure-four box trap,—but I could not see that the raccoons molested any of the many nests occupied by bird families in the surrounding woods and clearings. Porcupines and woodchucks were also numerous but apparently entirely harmless to birds. Eaton ('10, p. 234) brands the mink as a "most inveterate nest-robber." As to the marten, probably scarce in the lumbered districts today, Stone and Cram ('10, p. 243) say that "martens kill all sorts of birds and animals indiscriminately." Of the skunk they say nothing definite in this respect, but this animal will no doubt take what it finds in nests built on the ground; and fortunately it is not numerous in the western Adirondacks. Finally, Stone and Cram accuse the white-footed mouse, which is fairly common in this region, as follows ('10, p. 132): "In summer they appropriate the nests of songbirds, in bushes and low trees, fitting them up for use, just as squirrels do those of Hawks and Crows. It appears probable, moreover, that they are not over-scrupulous in the matter of waiting for the rightful owners to depart before taking possession, as they are great lovers of fresh meat, and have often been caught in the act of devouring both eggs and young birds."

Predacious Birds. Birds of prey are not common in the Adirondack mixed forest. I saw at Cranberry Lake only the Bald Eagle, Fish Hawk, Marsh Hawk and Broad-winged Hawk, none of which molests nesting birds. The Great Horned Owl was reported to me as living in the woods at Barber Point, but it certainly is not common. The Owl, with the Goshawk, the Sharp-shinned Hawk and Cooper's Hawk, are the recognized enemies of the birds, and all are too rare to be reckoned as important in that locality. This scarcity

of the large birds of prey means that their customary food, the small rodents, is not plentiful. The chipmunk is rather common, it is true, and it feeds in the burns and clearings alongside of the birds without exciting their interest. Its presence and that of the red squirrel may account for the occurrence of the Broad-winged Hawk. But the small rodents, ordinarily enemies of nesting birds, are evidently not prominent as an influence in the region.

Certain other birds, however, are more annoying and baneful to the small songbirds than are the so-called birds of prey; but fortunately, these also are restricted in numbers throughout the western Adirondack region. Eaton ('10, p. 53) reports that in the State of New York Crow Blackbirds, Shrikes, Crows and Jays kill smaller birds. "The three last mentioned are especially destructive to eggs and young birds. I have known many instances of Crows carrying away Robins and other young birds when nearly ready to leave the nest, and have seen Crow Blackbirds follow and kill young Robins which were able to fly several rods. I once saw a Bittern followed so hotly by a troop of Red-wings that she dropped the young bird which she was carrying away to her nest, and on examining the victim I found it was a Red-winged Blackbird, fully fledged, which the Bittern had speared through the side with her daggerlike beak. There is little doubt that the callow young of our perching birds are devoured by numerous flesh-eating species. The mortality among eggs is even greater than among the nestlings. Many species of otherwise inoffensive birds become egg-eaters during the nesting season. Blackbirds, Cuckoos, Catbirds and Wrens invade their neighbors' nests and destroy their treasures. Crows and Jays are probably the worst destroyers of eggs and nestlings, and I have seen the Crow on so many occasions in this nefarious business that I doubt if I could ever consent to regard him as a reputable citizen. The Cowbird is fully as noisome a pestilence from the standpoint of bird protection, for every young Cowbird is reared at the expense of a whole brood of vireos, warblers, finches or some other songbird."

Other writers have recorded the destructive propensities of many birds that do not belong to the raptorial group. Burns ('00, p. 66) mentions the fact that the eggs and callow young of the Flicker are sometimes destroyed by the Red-headed Woodpecker, the Crow, the Fish Crow and the Blue Jay. Forbush ('13, p. 370) records that the English Sparrow "has repeatedly been seen to destroy the nests of other birds, break their eggs, kill their young, mob them and drive them away from their homes. It occupies the houses of Bluebirds, Martins, Swallows and Wrens, and the nests of Barn Swallows, Cliff Swallows and Bank Swallows, and by persistency and force of numbers, drives the owners away. All careful observers who have watched the Sparrow ever since its introduction and have noted the effect produced upon other birds by its presence, agree that it is pernicious." These birds do not yet appear to be significant factors as enemies of the birds in the Cranberry Lake region. The Crow is represented only by a family here and there;

the Raven is so rare as to be negligible, and the Canada Jay is merely a chance straggler. The Blue Jay is a regular inhabitant of the margins of the wood but is not numerous; the Bronzed Grackle is uncommon, and the Cowbird is apparently absent from the plateau country, though it might be expected to follow the bush-dwellers into the higher clearings.

Snakes as Enemies of Birds. Another circumstance rendering the western Adirondacks a desirable summer habitat for birds is the comparative scarcity of snakes. The garter snakes are not greatly addicted to taking young birds, but some of the larger and more aggressive species make a practice of thus adding to their daily bill of fare in the bird-nesting season. Chief in the category of predatory snakes elsewhere is the blacksnake, which is absent from this region, as also is the rattlesnake. Most snakes feed mainly on small rodents, particularly meadow mice; and these, as I have already said, are few about Cranberry Lake, a fact that may partly account for the scarcity of serpents, as I suppose it does for the fewness of hawks and owls.

The Role of Predatory Species. It may not be altogether a blessing to bird life when natural enemies of every kind are lacking in their environment. Forbush ('16, p. 7) formulates a broad statement on this point as follows: "It is well known to naturalists that in a state of nature the natural enemies of any species are as essential to its welfare as are food, water, air and sunlight." He explains this principle as follows:

- (a) Natural enemies regulate the numbers of animals.
- (b) Natural enemies preserve the fitness of the animals on which they prey.
- (c) Some natural enemies regulate others.
- (d) Useful species may become harmful if not held in check by natural enemies.
- (e) Natural enemies supplement and check one another.
- (f) Natural enemies tend to keep the numbers of birds at their normal limit.

Forbush concludes that the natural enemies of birds are necessary and desirable as they tend to maintain within proper bounds the numbers of the species on which they prey; he also suggests judicious and moderate limitations upon the activities of the natural enemies, that the biological balance may not be disturbed by man's unwise intervention.

A CENSUS OF THE BIRDS AT CRANBERRY LAKE

A part of my plan for the season's work (1916) was a definite census of the bird life of each minor habitat, and by a combination of these to make an approximate estimate of the bird population of the region. Great difficulties were encountered in this work. The shrubbery grows breast high in all open spaces and the topography is chiefly of glacial formation, with ridges and depressions strewn with boulders of all sizes, the smaller ones usually hidden by bushes

with fallen logs, stumps left from early lumbering operations, and roots of up-turned trees, all forming a tangle so discouraging that a close search of even one local habitat would involve an entire season's sole and exacting labor. In these circumstances, to get a fair idea of numbers in the limited time available—the last half of the nesting period—it was deemed best to select typical portions of each minor habitat. At the time of my arrival at the Summer Camp, June 22, many of the birds of the neighborhood were feeding their young in the nests, or else had their first broods already on the wing, and July was well begun before the areas were exactly defined. Ordinary methods of making a census of birds in open country were here impracticable, and I had to devise one for the case in hand. Day after day the number of singing males in an area was estimated, generally early in the forenoon and frequently towards the end of the afternoon, when the songsters are at their best. Adult birds caring for young either in the nests or on the wing in the shrubbery, were regularly noted in each area, until nearly every family was approximately located and its movements known. One unfamiliar with an Adirondack burned tract or clearing of any kind, or with the ordinary bog or bog forest, can scarcely realize the meaning of a task involving a detailed search for nesting birds in one of these typical habitats. Berry thickets grow in a dense tangle, and overturned trees interpose masses of roots clogged with soil and rock fragments, thus shutting off the view ahead, and offering barriers skirted or surmounted with toilsome effort (figure 129); while hidden cavities of all sorts form pitfalls into which the searcher is continually sinking leg-deep.

The Campus and its fringe of trees and bushes comprise approximately 4 acres. The following birds nested in this area: Robin, 1 pair; a White-breasted Nuthatch roosted regularly in a hole at the top of a dead stub, but was not nesting there at this time; Red-eyed Vireo, 1 pair, 2 broods; Cedar Waxwing, 3 pairs; Bank Swallow, 10 pairs, in the sandbank margin facing the Lake; Song Sparrow, 2 pairs; Slate-colored Junco, Chipping Sparrow, Alder Flycatcher and Kingfisher, 1 pair each. These figures show a total of 10 pairs, an average of 2.5 pairs to an acre; or, by including the sandbank birds, we have 21 pairs, making an average of more than 5 pairs to the acre.

In the Partial Clearing, of about 4 acres, were found nesting: Robin, White-breasted Nuthatch, Brown Creeper, Catbird and Mourning Warbler, 1 pair each; Chestnut-sided Warbler, 2 pairs; Black-throated Blue Warbler, 1 pair; Red-eyed Vireo, 2 pairs; Rose-breasted Grosbeak, Song Sparrow, Least Flycatcher, Wood Pewee and Yellow-bellied Sapsucker, 1 pair each; or 15 pairs in all.

The Habitation Clearing measures approximately 8 acres, and its nesting residents were as follows: Olive-backed Thrush, 2 pairs; House Wren, 2 pairs; Catbird, 1 pair; Redstart, 2 pairs; Yellow-throat, 3 pairs; Chestnut-sided Warbler, 1 pair; Nashville Warbler, 1 pair; Red-eyed Vireo, 1 pair; Cedar Waxwing, 2 pairs; Rose-

breasted Grosbeak, 1 pair; Song Sparrow, 2 pairs; White-throated Sparrow, 3 pairs; Goldfinch, 1 pair; Bronzed Grackle, 2 pairs; Least Flycatcher, 2 pairs; Kingbird, 1 pair. This census shows 26 pairs.

In the Burn a typical space in the center was selected, where there was a depression, or great kettle-hole, in and around which grew several tall living trees, chiefly maples. This measured area contained 10 acres, and its nesting birds were as follows: Robin, Olive-backed Thrush, Chickadee and White-breasted Nuthatch, 1 pair each; House Wren, 2 pairs; Redstart, 1 pair; Canada Warbler, 1 pair; Yellow-throat, 2 pairs; Chestnut-sided Warbler, 3 pairs; Nashville Warbler, 2 pairs; Blue-headed Vireo, 2 pairs; Red-eyed Vireo, 1 pair; Cedar Waxwing, 2 pairs; Song Sparrow, 2 pairs; White-throated Sparrow, 8 pairs; Goldfinch, Ruby-throated Hummingbird, Least Flycatcher, Flicker, Sapsucker, Hairy Woodpecker and Canadian Ruffed Grouse, 1 pair each. This estimate makes a total of 37 pairs in the 10 acres.

The Bog adjacent to the Burn, and including a strip of second growth conifers with some remnants of original hardwoods, comprised approximately 9 acres. The nesting birds of this lot were as follows: Veery, 2 pairs; Chickadee, 1 pair; White-breasted Nuthatch, 1 pair; Canada Warbler, 1 pair; Myrtle Warbler, 3 pairs; Blue-headed Vireo, 1 pair; Cedar Waxwing, 2 pairs; Lincoln's Sparrow, 3 pairs; Slate-colored Junco, 1 pair; White-throated Sparrow, 7 pairs; Purple Finch, Yellow-bellied Flycatcher, Olive-sided Flycatcher, Flicker, Sapsucker and Arctic Three-toed Woodpecker, 1 pair each; a total of 28, or 3 pairs to an acre.

For the Virgin Forest count, an area of about 5 acres was selected, lying along the line where the Bog and the Meadow converged. It held the following species: Hermit Thrush, 3 pairs; Golden-crowned Kinglet, 1 pair; Red-breasted Nuthatch, 1 pair; Winter Wren, 2 pairs; Red-eyed Vireo, Magnolia Warbler and Black-poll Warbler, 1 pair each; or 10 pairs in all.

The long narrow Meadow tract comprised a fraction over 8 acres, and contained the following tenants: House Wren, 2 pairs; Maryland Yellow-throat, 7 pairs; Cedar Waxwing, 1 pair; Song Sparrow, 6 pairs; Chipping Sparrow, 1 pair; Rusty Blackbird, 1 pair. Here we find 18 pairs of birds.

In the Lumbered Clearing, a bushy area of 6 acres near the lakeshore was selected for counting. Its nesting birds included one pair each of Olive-backs, Redstarts, Canada Warblers, Yellow-throats, Mourning and Nashville Warblers, Red-eyed Vireos, Cedar-birds, Least Flycatchers and Crested Flycatchers; and of Chestnut-sided Warblers, 4 pairs; Song Sparrows, 2 pairs; and White-throats, 2 pairs; 19 in all, or about 3 pairs to the acre.

A representative patch of about 7 acres in the Open Hardwood Forest furnished this list: Chickadee, 1 pair; Winter Wren, 1 pair; Black-throated Blue Warbler, 3 pairs; Blue-headed Vireo, 1 pair; Red-eyed Vireo, 2 pairs; Scarlet Tanager, Wood Pewee, Yellow-bellied Sapsucker, Flicker, Junco, and Black and White Warbler, 1 pair each. This estimate shows 14 pairs in 7 acres.

Reviewing these statistics, it appears that in 1916 an average of about three pairs of woodland birds nested on an acre in the region surveyed. The burned tract appears to rank first as a preferred habitat, and the virgin forest gave fewest families.

I have at hand a report by Wells W. Cooke concerning bird counts in various localities, among them several made in woodlands, and to these I briefly refer for comparison. He states ('16, p. 9) that "in the mountains of Arizona, near Flagstaff, a tract of 70 acres at about 7,100 feet elevation, covered with western yellow pine and Gambel oak, supported a bird population of 31 pairs of 18 species." Also, along the shore of Flathead Lake, Montana, 45 acres of woodland had 67 pairs of 24 species. Again, "a 60-acre tract of wooded hillsides near Gilroy, California, was supporting 36 pairs of 10 species." The foregoing data indicates that the western part of the Plains, the Rocky Mountain region, and the Pacific slope contain a smaller number of birds per acre than the Eastern States under nearly similar conditions. From all the evidence submitted, I am warranted in concluding that the Adirondack region holds a leading place among forest habitats as a summer home for birds.

A LIST, WITH NOTES, OF THE SUMMER BIRDS ABOUT CRANBERRY LAKE

The making of the subjoined list was not the motive of my work at the Forestry Camp on Cranberry Lake, but incidental to it, and more species might have been recorded during the period given to my observation—June 22 to August 20, 1916—had that been the primary object. In the notes regarding each species special attention had been given to the local factors determining habitat preferences rather than to so-called zones of life, for the reason that all the birds herein enumerated are practically included in the one general type of mixed forest in one or another of its varying aspects. My concern was chiefly with the land birds, as dwellers in the forest, little attention being paid to the water birds, which in fact are few about such a typical forest lake lacking in water plants. Cat-tail swamps, with areas of open water margined by reeds and rushes, are rather rare in the western Adirondacks. The water birds of the region can therefore all be accounted for either as those nesting usually in tree cavities, as do the Merganser and Wood Duck; or those feeding principally on fish, frogs and related kinds of food, as the Heron and the Loon. Moreover, the influence of the Ontario-Oneida water plain on the west, and of the Hudson-Champlain waterway on the east, both attractive to the aquatic birds of northern New York, might serve to lessen their frequency here.

The list includes a few species (indicated by an asterisk) not directly observed by me in the season of 1916, but which occur more or less regularly throughout the western Adirondack region and are noticed to some extent in the course of travel through the Park. The records are well authenticated, but as a rule the birds mentioned

are not common, nor represented by many individuals. The absence of a certain group of them, including the Acadian Chickadee, Gray-cheeked Thrush, Blackburnian Warbler, Parula Warbler, Pine Siskin, Raven, Canada Jay, American Three-toed Woodpecker and Canada Spruce Partridge classed as belonging to the Canadian fauna, can be accounted for when we remember that they prefer the purely coniferous associations. To these birds the broadleaf trees are an effectual barrier, and they scarcely occur even in mixed forests in which the deciduous trees are in the minority. Moreover, the conifers in their climax growth have little attraction for the species of this group, which seem to prefer swamps, bogs, thickets of second growth, and other altered aspects of the forest rather than the original or "virgin" woods. The absence of these birds in summer at Cranberry Lake indicates the predominance of the so-called Alleghanian influence there. On the other hand, the long list of warblers in this lake district gives it a somewhat Canadian aspect; but it is idle here to speculate on the question of the limits of zoological zones.

The scarcity of birds of prey is noticeable, and has been commented upon elsewhere. Woodpeckers abound, for many features of the region make it an attractive habitat for these birds. The extensive burns are littered with standing dead trees and stubs suitable for their nesting holes, and the mixed forest contains the food sought by these woodland foragers. Flycatchers are also numerous and well sustained. The alder swamps teem with water-bred insects, as do the bogs; the *Sphagnum* is a breeding place for mosquitoes and small flies, midges, "punkies" and various other pests; and the decaying stumps, ground litter, and low growth of burns and clearings harbor hordes of insect prey. Of the finch family I find one group well represented, and another group but meagerly so. The first group includes those feeding on the tree seeds and shrub fruits; the second consists of sparrows of the open fields and meadows. In the former association we have the Purple Finch, the Crossbills, Goldfinch, White-throated and Chipping Sparrows, Junco, Song Sparrow, Lincoln's Sparrow and Rose-breasted Grosbeak. To the sparrows of fields, pastures and short-grass meadows, the region offers no suitable conditions, and hence they are represented only sparingly and locally at the lower elevations.

*BLUEBIRD. *Sialia sialis sialis* (Linn.)

Length 7 inches. Above, azure blue; below, reddish brown; vest white.

The Bluebird was not seen by me at Cranberry Lake, but I am told that a pair had nested at Barber Point previous to my visit. The Bluebird was well known to the generation now passing, but has not been so familiar to the youth of today. Once it nested in every village and farm garden; then it gradually forsook these domestic scenes and made use of fence posts along secluded roads

* Indicates a species not directly observed by the author, but reported by others from this region.

and stumps in woodland clearings. Although recently the Bluebird has become more generally noticeable, it is doubtful whether it will recover its former place of familiarity about houses.

ROBIN. *Planesticus migratorius migratorius* (Linn.)

Length 10. Upper parts slaty brown; head darker; breast chestnut-red; vent and corners of tail (shown in flight) white.

The Robin is associated with clearings or with woodlands in the vicinity of human haunts. In the early weeks of spring the Robin is a bird of the lawn, dooryard and garden, where it seeks the earthworms and similar food then abundant near the surface of the ground, and where water is at hand for bathing and mud for its nest. In the middle of the summer it resorts more to fruit gardens and berry patches, especially while it is feeding and training its young. After the garden fruits and berries have failed, in the late fall, the Robin hunts in the wild woods and ravines. The singing of the Robin, as of other birds, is an accompaniment of the breeding season, and is continued until the young of the last brood leave home. In the Cranberry Lake district most of the second broods of Robins are on the wing by July 25, and then Robin music ceases, and the harsh squeaks of the juveniles betray their presence in the fire cherry and berry thickets. About July 20, elderberries are ready and raspberries begin to ripen. From that time Robins in the Adirondack region haunt the fruit-producing areas, flocking together more, and thus pass the remainder of summer until the end of August, after which they devote themselves to the mountain ash and other late supplies of wild fruit, but avoid the depths of the forest. The nest of mud and dried grasses and plain greenish blue eggs of the Robin are well known. The highest site I have ever seen was on a maple limb about forty feet above the ground.

HERMIT THRUSH. *Hylocichla guttata pallasi* (Cab.)

Length 6.5. Smallest of the Thrushes; back and sides, brown; tail rust-red, often tilted up and down; lower surface white, with rows of arrow-head-like black marks except on throat and belly.

Wherever a patch of virgin woods borders a bog or burn, the Hermit Thrush may be heard at almost any hour of the day during its song period; and where the dark forest contains openings of sphagnum moss, or is rankly overgrown with cinnamon fern in small illuminated spots, there the Hermit Thrush dwells and sings and rears its brood. In such places there are frequently large boulders carpeted with green mould and supporting a thick growth of fern, and in such sites the Hermit Thrush often makes its nest, the top of the boulder giving it a sheltered vantage point and the clustering fern affording concealment. Frequently the Hermit Thrush will make its nest somewhat outside the forest margin, in the base of a fern-clump or bush, or on a mossy, sheltered log, yet seldom far from the borders of the forest. The nest is sunken in the moist earth, among the grasses and ferns; composed of fine rootlets, hemlock twigs, forest leaves, mosses, fine weed stems and grasses, and

lined with pine needles and very fine black rootlets and grass tops. The eggs are pale greenish blue. It sings and gleans its food well within the shaded cover, but so near the open that the bird occasionally can be seen before it darts swiftly from view.

The singing of the Hermit Thrush is quite distinctive and characteristic and its tones are often compared to those of a flute. Many persons confuse the Hermit's songs with those of the Wood Thrush, but there is such uniformity in the singing of the latter and so much more variety in the Hermit's, that the identity of the songster should not be long in doubt to discriminating listeners. When the Hermit Thrush is heard at a distance its notes have a mellow, flute-like quality, but when the songster is near by one hears high-pitched, falsetto tones, somewhat squeaky and faltering, as if the performer were attempting to repeat some of his phrases an octave higher, and found them quite beyond his compass. A harsh alarm call is uttered when the bird is lurking in a thicket and is disturbed by an intruder. I have heard this call only in the virgin woods, and to my ear it sounds something like the scolding note of the Red-eyed Vireo or the Canada Jay. This Thrush's song period is prolonged until the middle of August, somewhat later than that of either the Olive-back or the Veery.

OLIVE-BACKED THRUSH. *Hylocichla ustulata swainsoni* (Tschudi)

Length 7. Back and flanks olive-brown; tail without rust-red tint; sides of head and breast buffy; breast crossed by a band of wedge-shaped spots; throat and belly white.

Abandoned lumber clearings with clumps of mixed saplings including balsam firs, are frequented by the Olive-backed Thrushes, as they prefer to nest in young evergreens. The singing of this Thrush is one of the early morning and evening pleasures offered the visitor at Cranberry Lake in midsummer, and it is distinctly different from that of either the Hermit or the Veery. The notes have a bell-like quality easily distinguishable. The song period is shorter than that of either of the others, as the young are usually out of the nest by the middle of July, and the males cease to sing soon after the juveniles are on the wing. * Both adults and juveniles then frequent the burns and clearings where fruit and berries are plentiful.

The nesting of the Olive-back begins in June and its habits then are remarkably uniform throughout its entire range. The favorite situation for the nest is a crotch in a fir or maple sapling less than ten feet from the ground. The nest rests on a foundation of loose grasses, and its walls are made of dried grasses, green lichens, and fine weed stems. The lining is generally of fine grass, horsehair, and a little moss. The eggs are light greenish blue. The open nidification of the Olive-backed Thrush is seemingly at variance with its shy, secretive disposition, and the sitting bird generally lingers with her charge until she is certain that the observer means to disturb her; then she flits from the nest and disappears in the shrubbery, where she lurks in silence or occasionally manifests her anxiety by the characteristic *whit* from a hidden covert, while the male goes

on singing. In many instances the nests are quite unconcealed. The young hatch about July 1 and are fed in the nest by the parents for two weeks. The presence of an Olive-back in a district is revealed by the alarm call at nightfall,—a short, gurgled note like *gunt* or *whut* heard chiefly toward dusk, and also about its nest when disturbed. The alarm note is a sure means of identifying this Thrush.

WILSON'S THRUSH; VEERY. *Hylocichla fuscescens fuscescens* (Steph.)

Length 7.5. Back, wings and tail *cinnamon-brown*; breast buff with faint marks; surface below, pure white.

The Veery is an inhabitant of boggy clearings, or wherever there are open sphagnum woods. It favors the mossy portions of an ill-drained open knoll, where upturned roots have left cavities for sphagnum growths, with great clumps of cinnamon fern spreading in the sunshine among clumps of small conifers, hardwoods and bog shrubs. In the neighborhood of Barber Point, up Sucker Brook, three sharply defined areas are illustrative of the habitat preferences of the local Thrushes. The Burn, with its aspen-fire cherry-birch association, is a characteristic haunt of the Olive-backed Thrush; alongside the Burn, and abruptly joining it, is a bog forest, the home of the Veery; and alongside the Bog, by a change as abrupt as the other, is a strip of dark virgin forest where the Hermit Thrush dwells.

The singing of the Veery is as distinctive as that of either the Olive-back or the Hermit. Its peculiar quality is its vibrant character, like the sound of a fine piano wire set in vibration and dying away of its own accord. The phrases of the Hermit end somewhat abruptly, while those of the Veery vibrate lower and fainter to the utmost diminuendo. For close comparison I would say that the songs of the Hermit are identified by their mellow, flute-like tones; those of the Olive-backed Thrush by their ringing, bell-like quality; and the Veery's by their resemblance to the tones of a fine, taut wire vibrated under a bow and allowed to come to rest.

Glover Allen says of Wilson's Thrush in New Hampshire that "numbers follow back the little side streams well up on to the mountainsides, so that it is possible in some places to hear the Hermit, the Olive-backed and Wilson's Thrushes all singing at once." This is in agreement with similar observations that I made in 1916 at Cranberry Lake, where all were present together. Allen's description shows that the three species were occupying overlapping habitats depending upon the vegetational association each preferred, while my observations indicated that they were choosing customary environments at the same altitude.

The nest of Wilson's Thrush is generally made on the ground, on a moss-covered log, or on a low humus-covered rock. One that I examined was on a low flat rock amid moss and shrubs. It was made chiefly of coarse fern stems, and was situated near the base of a clump of ferns. Frequently the nest is made on a foundation



PLATE 32. CHARACTERISTIC BIRDS OF THE BOG CONIFER FORESTS

- | | |
|----------------------|----------------------------------|
| 1, Veery (Thrush). | 4, Arctic Three-toed Woodpecker. |
| 2, Magnolia Warbler. | 5, Myrtle Warbler. |
| 3, Lincoln Sparrow. | |

Drawn by Edmund J. Sawyer

of dead leaves that have lodged in the base of a clump of sprouts or saplings, or at the base of a branch standing upright on a prone log.

GOLDEN-CROWNED KINGLET. *Regulus satrapa satrapa* Licht.

Length 4. Crown orange and yellow, bordered by black.

The Golden-crowned Kinglet is closely associated with spruces, balsam, tamarack and hemlock. In late summer, after the young are on the wing, a family group will hunt restlessly in a clump of spruce or fir for many minutes, flitting from twig to twig after the manner of Warblers in feeding, and uttering their thin-voiced *see-dee*, accented on the second syllable and repeated two or three times. In its busy life the Golden-crowned Kinglet associates with the Chickadee and the Red-breasted Nuthatch, the last named being as characteristic of the virgin woodlands as the Kinglet itself. As a rule, the Golden-crowned Kinglet prefers well established second growth to undisturbed primeval forest, very old burns that have been fairly recovered with mixed woods in which the conifers predominate being perhaps the first choice of this diminutive dweller of the woods. It chooses the fir as its usual nesting place, and forms a cradle of moss, lined with feathers or fur, that partly hangs beneath the fork at the end of a drooping branch. The eggs are creamy white, profusely spotted.

CHICKADEE. *Penthestes atricapillus atricapillus* (Linn.)

Length 5.5. Light gray and white, with a black cap and throat; flanks brownish.

The Chickadee hunts in all kinds of places and on every sort of tree, but seems to prefer hardwood scrub. It calls its name every few moments and also utters a quiet little phrase somewhat like *tick-a-dee-purrt*, variously modified, and heard when several are foraging in company. In the mating season or when the Chickadee desires companionship it calls *pee-wee* in a slow, plaintive tone, each syllable lengthened and the first emphasized, which amateurs frequently mistake for the call of a Woodpecker or a Phoebe. A good imitation of this will often bring a solitary or curious Chickadee within arm's length of the whistler. The nest is made in a natural cavity in a tree, or more often in a Woodpecker's abandoned nest-hole, and contains sometimes as many as eight red-speckled eggs.

The Hudsonian Chickadee has been reported in this western district, but I did not see it.

RED-BREASTED NUTHATCH. *Sitta canadensis* Linn.

Length 4.6. Bluish gray above, reddish brown below; black stripe through the eye and white line over it.

This Nuthatch is naturally a bird of the higher virgin forest, and here frequents its margins, near open places. Its piping nasal call is one of the regular sounds of the woodlands, frequently interrupted by the louder scolding of the red squirrel or the rippling song of the Winter Wren. When a patch of virgin forest is bord-

ered by open, culled woods, this Nuthatch can be heard from the dense timber while the White-breasted Nuthatch utters its call from the scattered trees of the more open area. The difference in the calls is very noticeable, those of the White-breasted being deeper, hoarser, and more throaty than the notes of the Red-breasted, which do not seem to have the *nk* quality so noticeable. Both Nuthatches make their nest in holes and crevices of trees and lay red-speckled eggs; but that of the Red-breasted is distinguished by a daubing of resin about its entrance.

WHITE-BREASTED NUTHATCH. *Sitta carolinensis carolinensis* Lath.

Length 6. Upper parts grayish blue; crown and nape black; *under surface white*; vent reddish; outer tail quills with white patches.

The White-breasted Nuthatch is a bird of the open, cleared spaces, where it seeks its food on large trees; and it nearly always chooses the hardwoods, alive or dead, for its foraging, and works with great diligence and patience. It utilizes a hole in a stump or tree as its sleeping quarters for the night. A White-breasted Nuthatch had a cavity which is used in this manner, a hole made by a woodpecker at the top of a dead stub, in the Partial Clearing. Every night about sundown the Nuthatch would seek this shelter. Once, after it had retired for the night, a Downy Woodpecker came foraging for a morsel of dessert for its late supper, and clambered up the stub as it inspected the bark. It chanced to keep to the other side of the stub until it reached the top, when it sidled around and discovered the hole just below the top. The woodpecker moved to enter the cavity, but a movement from within warned it that the place was tenanted, and the Downy hastily fluttered around the stub to another position. Again the woodpecker circled the stub and looked into the hole, but again the tenant gave it a sharp reminder of its own claim, when the intruder withdrew and continued its untimely foraging elsewhere.

BROWN CREEPER. *Certhia familiaris americana* Bonap.

Length 5.6. Upper surface brown sprinkled with gray; tail plain and pointed; under parts white; *bill slender, curved*.

The Brown Creeper is an inhabitant of the mixed woods, preferring them in their more open aspect. Mature trees are essential to the Creeper and it constantly associates with the Downy Woodpecker, White-breasted Nuthatch and Chickadee. I first heard the song of the Creeper here. An adult was at work getting and carrying food for several young birds lately out of the nest. He gleaned chiefly from the trunks of maples and beeches, and as he climbed about he sang from time to time, usually only when well up toward the top of the trunk. The song was a weak but pleasing twitter or warble much like that of the Black and White Warbler,—a chattering expression of content distinctly different from any other song heard in the open woodland association. The date was July 22, long after the Brown Creeper is supposed to have concluded his

household cares. In the latter part of the summer the Brown Creeper utters a short clear whistle, a single note resembling the syllable *tseet*, framed by tongue and teeth. This note is enunciated oftenest as the Creeper travels up a tree trunk, and the whistle is given after the bird has enjoyed a dainty titbit. The nest is a bundle of soft stuff tucked in a crevice under loose bark, and the eggs are white with brown spots.

WINTER WREN. *Nannus hiemalis hiemalis* (Vieill.)

Length 4. Upper parts deep brown; wings and tail with dark bars; under parts light brown, barred with black and white; *line over eye tawny*.

The Winter Wren frequents not only the dark solitudes of the forest but more open spaces, frequently along the small watercourses that drain patches of bog or miniature ponds amid fallen trees, tangled shrubbery, mossy logs and boulders. A favorite nesting site is among the roots and earth upheaved by an overturned tree. One nest examined in such a situation on June 24 had young about ready to fly. Nesting dates for this wren vary considerably, as on July 31 two broods were seen in the dark virgin forest which apparently had just left the nest. It is interesting to watch these youngsters when disturbed. They scatter like young Bob-whites, some crouching in the sparse ground cover, while others may seek higher shelter. One was noticed clinging to the bare bark near the base of a large tree, like a growth on the bark, silent and watchful, seeking to avoid detection while the adults were scolding forcibly under cover near by and trying to draw the brood from the threatened danger.

HOUSE WREN. *Troglodytes ædon ædon* Vieill.

Length 5. Upper surface cinnamon-brown; faintly barred; under parts gray; *tail rather long*.

The House Wren is a bird especially of the Habitation Clearing and the borders of the campus, and has no association with bogs or real woods. It stuffs some hole in a dead stub, or a convenient crevice elsewhere, with twigs, in the midst of which is a soft little nest and six or eight red-peppered eggs. After the young leave the nest, the House Wrens resort to the shrubbery of burns and clearings, where they skulk under cover until they disappear late in the fall.

* BROWN THRASHER. *Toxostoma rufum* (Linn.)

Length 11.4. Upper surface rufous; below, white, spotted with black on breast, belly and sides to the angle of the mouth; bill long and curved.

This bird was not observed by me in the season of 1916 at Cranberry Lake. Merriam mentions the Brown Thrasher as occurring with the Catbird and the Wood Thrush about the western foothills and borders of the Adirondack region. Of these three species, the Catbird has become an established and regular resident at Cranberry Lake, but the others have not yet become noticeable.

CATBIRD. *Dumetella carolinensis* (Linn.)

Length 9. Slate-gray, with black head and tail; under tail-coverts chestnut.

The Catbird inhabits the Partial and Habitation Clearings and the bordering scrub about the campus. In the parts of the Burn nearest the Camp this species was much at home, especially in the season of ripe fruits and berries. The Catbird is an example of those species that extend their range under suitable inducements, for early accounts show that it was then confined to the borders of the wilderness, while now it is met with throughout the Adirondack plateau.

REDSTART. *Setophaga ruticilla* (Linn.)

Length 5.4. Black; sides of breast, band in wings and on tail, rich salmon-red (yellow in female); lower parts white.

The Redstart has very little association with the virgin forest, but frequently dwells along the border of the bog forest where such vegetation meets a burn or clearing. It enjoys small swampy spots thickly grown with maple or willow or birch, perhaps with water under-foot, the whole open pretty well around but darkened within. In such retreats the Redstart hunts for its insect fare, and in an upright fork makes its nest of bark and hemp-like fibres and lays red-specked eggs.

CANADA WARBLER. *Wilsonia canadensis* (Linn.)

Length 5.5. Ash-gray above, forehead and crown blackish; below yellow, a broad band of black spots crossing the breast; no white on wings or tail.

This lively warbler haunts boggy and burnt clearings and the scrub along the verge of the deep forest where plentiful light penetrates the tangle and water is accessible. Ralph Hoffmann speaks of it as very inquisitive. "An intruder may frequently hear its alarm-note, *chick*, or catch a glimpse of the black 'necklace' across its yellow breast as it flies low in the bushes. Its song is a rather hurried out-pouring of notes, introduced by the same *chick* which it uses as an alarm-note." Its nest is half hidden in a stream bank overhung with moss, or some similar fastness; and the eggs are white with reddish spots about the large end.

MARYLAND YELLOW-THROAT. *Geothlypis trichas trichas* (Linn.)

Length 5.2. Above, olive-green; forehead and cheeks black, bordered on the nape with gray (no black mask on the female); below, bright yellow becoming whitish toward the tail.

The Yellow-throat inhabits bushy openings wherever there is sufficient moisture to produce a grassy growth among the shrubbery. It chooses swampy depressions in the Burn, or the weedy margins of streams and shores of ponds and lakes. The Meadow is an especially favorite habitat here, for, while dry in the summer, it supports tall grasses, iris and small berry bushes, a combination well liked by this ground-creeping Warbler. Among the stout grass stems it can clamber and search for food; and after one of its fluttering, ecstatic

flight-songs it can drop down into a safe covert. The Yellow-throat's first choice is a regular cat-tail swamp in whose shrubby border it can find a convenient cluster of iris in which to hide its nest and red-spotted eggs.

MOURNING WARBLER. *Oporornis philadelphia* (Wils.)

Length 5.4. Head bluish slate-color; back and tail olive-green; throat blackish; breast black; lower part yellow; no white anywhere.

The Mourning Warbler is an inhabitant of the shrubbery of clearings usually dry. It likes a partly cleared knoll, where there are logs and stumps overhung by scattered clumps of bushes and saplings. There it sings low in the shrubbery, skulking just out of sight and uttering intermittently its loud, clear notes. The Mourning Warbler seems to live in a zone between the ground and the lower portions of the bush foliage, utilizing a plane of the clearing unappropriated by any other warbler. Toward evening the male will begin to make the round of the small area it frequents, singing as he halts here and there to pick up a bit of food, and slipping noiselessly and shyly from one station to another. Its nest is made on or near the ground and its eggs are spotted with reddish brown.

WATER-THRUSH. *Seiurus noveboracensis noveboracensis* (Gmel.)

Length 6. Upper parts dark brown, a buffy line over the eye; under surface buff, profusely spotted with black.

The Water-Thrush dwells near quiet pools or brooks where alders clog the shallow levels of the stream and where bushes fringe the margins. Here is heard its loud song, a series of *twits*-s in rising emphasis, and a series of *twee*-s in falling, a curve or arc of music rising with gradual elevation and then curving abruptly downward like a rocket shot outward at a low angle. The bird itself is not often seen, though it is inquisitive and frequently comes into view when its curiosity is aroused by the anxious chirping of another bird disturbed by the observer. Once this summer, when a Song Sparrow was chirping nervously at my presence near a land-locked pool of the brook, a Water-Thrush came out from its retreat under the overhanging shrubbery and perched in the base of the sapling clump where the sparrow was voicing its anxiety for the safety of its young hiding in the thicket. The Water-Thrush teetered on its perch and peered about the spot as if to determine the cause of the disturbance, almost within arm's length of me. On another occasion this summer, near the same quiet little pool, while I was hunting for the nest of a pair of White-throated Sparrows, which were loudly chirping around and overhead in the saplings, four pairs of warblers came and hopped about with the Sparrows,—Water-Thrushes, Myrtle Warblers and Magnolia Warblers,—all interested in the disturbance, apparently unafraid of the real cause of the confusion, and each uttering its characteristic chirps and calls. The Water-Thrush places its nest in some nook of an overhanging bank near the water, and lays white eggs, delicately speckled.

OVEN-BIRD. *Seiurus aurocapillus* (Linn.)

Length 6.2. Upper surface brown; *crown dull orange*, edged with black, lower parts white, black-spotted.

The Oven-bird frequents dry open woods, and it seems restricted to this habitat. The favorite woodland must be well matured, as for example, the forest on a dry knoll where lumbering was done in an early day so that the large deciduous trees were left tolerably intact, and second growth conifers are now mixed in small proportion. An undue amount of ground cover will cause the Oven-bird to look elsewhere, for it prefers places where it can walk about unhindered in hunting its food among the leaves and litter. It derives its name from the shape of its nest, which is made in a little niche on some wooded hillside and arched over by twigs and leaves, with an entrance at the side; thus reminding one of an old-fashioned outdoor oven. The eggs are white with red and brown spots.

BLACK-THROATED GREEN WARBLER. *Dendroica virens* (Gmel.)

Length 5. Back olive-green; *cheeks greenish yellow*; *throat and breast black*; under parts white, streaked with black; vest yellow; wing-bars and spots on tail white.

This warbler is associated with the coniferous species of the mixed woods, preferably in its more open aspects in the minor growth along the borders of a bog or the virgin forest. Mearns reports that "it is found everywhere, in all kinds of woods; but is especially numerous in hemlocks growing among deciduous trees." Hoffmann describes it as "the chief inhabitant of the white pines, where one hears continually its wheezy notes. It is also a common resident of the red cedar or savin groves of southern New England, and of the spruces of northern New England and New York."

* BLACKBURNIAN WARBLER. *Dendroica fusca* (Müll.)

Length 5.3. Back black streaked with gray; crown and line under eye black; *throat, breast and line over eye bright orange*; wide white wing-bar; lower parts yellow, streaked on the sides.

This gaudy warbler was not seen by me, but it has been frequently reported in neighboring counties and will no doubt be found some day at Cranberry Lake. Eaton speaks of it in the Adirondacks as "one of the characteristic woodland warblers, being practically as abundant in the depths of the forest as about the edges of clearings or along the streams." It nests and hunts and sings its thin, sharp warbling, high up in the evergreens.

BLACK-POLL WARBLER. *Dendroica striata* (Forst.)

Length 5.5. Back streaked gray; *crown black*; *cheeks and wing-bar white*; lower surface white, streaked on the sides.

The Black-poll seems to prefer the open bog forest where there is an association of young and medium-sized conifers in sphagnum ground, and of low bog shrubs in cleared spots and illuminated openings. This preference for small growth leads the Black-poll higher on the mountainsides than other warblers associated with coniferous forest.

CHESTNUT-SIDED WARBLER. *Dendroica pensylvanica* (Linn.)

Length 5. Back streaked; cap yellow, bordered at the eye with black; under surface white; sides broadly splashed with chestnut-brown.

The Chestnut-sided Warbler is associated with all kinds of clearings. It is one of the commonest birds of the Burn. If it can find berry bushes in which to nest, and saplings in which to forage and sing, it is immediately at home. It inhabits a zone or level in the scrub just above that of the Mourning Warblers, but nests in low shrubbery, commonly among the stems of raspberry and blackberry bushes at a foot or two from the ground. It lacks the fear and shyness of the other bush-dwelling warblers, and will carry on its activities regardless of the presence of an observer, much like a Chickadee. It scarcely ever gives forth any calls or notes of alarm when disturbed in feeding its young, but quietly continues its work as if accustomed to observation, singing contentedly as it works among saplings or the lower branches of trees. A representative song of this warbler sounds to me like *sweet sweet sweet sweet-sweet-see-chew*, consisting of four or five uniform notes, followed by the short, hurried sentence of three notes, stressed on the second. The song is frequently only the introductory series of notes, like *see see see see see*, with the short closing sentence omitted; at other times merely the *see see chew* is heard, strongly accented on the second note. Three forms of the song are thus recognizable. Singing continues while the father is feeding the young recently out of the nest; and usually after carrying a bit of food to a fledgling skulking in the shrubbery the male will fly to a convenient station and utter an abbreviated song before continuing his duties.

The Chestnut-sided Warbler leads a happy, homelike life for several weeks after the young leave the nest, the adults attending the juveniles with parental interest in the saplings near the nest. At this season the male sings a quiet little strain, a low murmured chatter or warble. When I first heard it I felt certain that a small Vireo, Bell's, as I had heard it in the Illinois berry thickets, was in the patch of alders. A family of this warbler will remain in the same clump of saplings for several days, if undisturbed.

The Chestnut-sided Warbler seems to be nearly altogether insectivorous. On one occasion this summer, however, I observed a male pick and eat two elderberries while gleaning leisurely among sapling foliage in which the berries were temptingly drooping; indeed, the bird's manner gave me the impression that it was eating the fruit more as an experiment than because of an established taste for the berries.

MAGNOLIA WARBLER. *Dendroica magnolia* (Wils.)

Length 5.1. Head ash-gray; back and cheeks black; large patches of white on the wings and tail; tail broadly tipped with black; under parts yellow; breast and sides heavily streaked.

The Magnolia, or Black and Yellow Warbler, is an inhabitant of the mixed woods where conifers predominate, preferably in the more open lighted areas. Its most favored habitat here was the

rather open bog forest. Conifers probably form the chief influence in determining the resorts of this bird, which follows the hemlock, spruces and balsam well up on the mountainsides. Benjamin Hoag ('94, p. 87) describes the nesting of the Magnolia Warbler at Stephentown, New York, as follows: "They had chosen for their summer home a woodland corner on the higher ground above a timbered swamp. Here in past years some of the timber had been cut, leaving little clearings among the tall pines, hemlocks, and deciduous trees, . . . and just across an old wood-road from one of these bush-grown clearings the nest was located. It was about six feet from the ground, on one of the lower limbs of a hemlock sapling, and was loosely constructed of fine hemlock twigs, weed-stems, and a few scraps of yellow-birch and wild-grape barks; lined with fine rootlets and horsehair."

MYRTLE WARBLER; YELLOW-RUMPED WARBLER. *Dendroica coronata* (Linn.)

Length 5.6. Upper parts mottled blue-gray; crown-patch and *rump yellow*; throat, wing-bars, tail-spots and belly white; breast black at the sides, heavily spotted below.

Sphagnum-carpeted localities, with scattered clumps of young spruces and firs and occasional deciduous trees, making the area about half open, are most favored by the Myrtle Warbler. It obtains its food mainly from spruces and fir, and nests in their lower branches, laying grayish white eggs spotted with brown. I did not find this warbler so plentiful at Cranberry Lake as is the Chestnut-sided, but the prevalence of clearings made the latter more noticeable than the former, as the Myrtle Warbler has little to do with clearings except where they meet the woods.

BLACK-THROATED BLUE WARBLER. *Dendroica caerulescens caerulescens* (Gmel.)

Length 5.2. Upper parts grayish blue; *white wing patch*; sides of head, throat, sides of breast and belly, black; otherwise, white below.

This Warbler prefers the typical mixed woodland in its dry open aspect. The preferences of this warbler in its Canadian summer home are described by Kells ('87, p. 76): "The favorite habitat of the Black-throated Blue Warbler is high, hardwood, timbered lands, where there is a thick growth of low underbrush, and while the males seek an elevated position among the leafy boughs for the display of their musical talents, the females usually select a lowly site for the cradle of their progeny." This characterization applies to the bird's habits here, as I encountered it in the Partial Clearing, and also in the dry open woods across Sucker Brook. Egbert Bagge ('87, p. 90) gives an interesting account of this warbler's habits near Holland Patent, in Oneida County. He describes the locality as high and dry ground, nearly, if not quite, surrounded by a swamp. "On this knoll, which was covered with large timber standing rather openly, but grown up thickly with brush from three to ten feet high, on the driest part where the brush was lowest, and

composed almost entirely of sugar maple, we found three of the four nests which rewarded our efforts." One of the nests was placed two feet from the ground in the upright fork of a little maple bush. Another nest was in the upright fork of a little maple nine inches from the ground. The third was only a foot from the ground. The nests were made of strips of rotten wood, held together and lined with fine black roots and a few strips of bark.

To me the usual song of this warbler sounds quite like the syllables *me gee h-e-e*, with the second syllable accented and the third somewhat lengthened or drawled. It may have other musical expressions, but this one song is definite and characteristic, and the one oftenest heard, as monotonous as the repetitions of the Red-eyed Vireo.

* YELLOW WARBLER; SUMMER WARBLER. *Dendroica aestiva aestiva* (Gmel.)

Length 5.1. *Everywhere yellow*, greenish on the mantle; breast inconspicuously streaked with fawn-color.

I did not see this warbler at Cranberry Lake, nor is it often seen in the forested parts of the mountains owing, in my opinion, to the absence of extensive willow growth in the plateau region. Swamps of *Salix*, or places where the willow grows in clusters in river valleys, are the situations that attract the Summer Yellowbirds.

* NORTHERN PARULA WARBLER. *Compsothlypis americana pusilla* (Wils.)

Length 4.7. Upper parts *grayish blue*; patch of yellow in the middle of the back; lower parts yellow, brownish on the breast and white near the tail; white wing-bars.

The Northern Parula Warbler is very closely associated with "the bearded pines and the hemlocks" wherever they are draped with tufts of the pale green *Usnea*. Very little of this lichen is found in the Cranberry Lake district; hence the Parula was not present. It should be found in Adirondack swamps wherever the *Usnea* occurs.

NASHVILLE WARBLER. *Vermivora ruficapilla ruficapilla* (Wils.)

Length 4.7. *Head ashy*; upper surface, light brown; lower, yellow.

Open bushy tracts in dry locations are probably the first choice of the Nashville Warbler, preferably with a trace of human surroundings, such as an abandoned mill site, neglected to grow up to berry bushes, pasture grasses, and sapling clumps. Any small tract of this character will invite this warbler, but it avoids the forest. It makes its nest on the ground.

BLACK AND WHITE WARBLER. *Mniotilta varia* (Linn.)

Length 5.3. *Striped*, black and white.

The Black and White Warbler lives in broken woodlands chiefly where the deciduous elements are pronounced, and probably occurs most frequently in medium-sized timber. Its habit of feeding is much like that of the Brown Creeper, for it travels up and down a

tree trunk or a stout branch in a creeper-like manner, searching the crevices of the bark for insects and their larvae or eggs. Its voice is thin and sharp. The nest is situated on the ground.

BLUE-HEADED VIREO. *Lanivireo solitarius solitarius* (Wils.)

Length 5.6. Head slaty; back lighter gray; wing-bars white and a white space about the eye; under parts white, brownish at the sides.

The Blue-headed Vireo inhabits woodlands. Its preference is for timber in the dry, open aspect, where the upper portions of ridges support an uncrowded growth of mature hardwoods with little underbrush; yet it frequently dwells in the sunlit margin of a bog forest, or of a burn.

***WARBLING VIREO.** *Vireosylva gilva gilva* (Vieill.)

Not seen by me. Eaton says that it undoubtedly breeds in every county of the State with the exception of the interior of the Catskill and Adirondack districts. The Warbling Vireo may be distinguished from the familiar Red-eyed, by its smaller size, yellowish ventral tinge, and lack of a dark line through the eye.

RED-EYED VIREO. *Vireosylva olivacea* (Linn.)

Length 6.2. Brownish above; crown gray, with a narrow black border; whitish line over eye; lower surface white.

The Red-eyed Vireo abounds in almost all aspects of the forest except dense bog woods. It lives in clearings where small trees have obtained a standing, in the borders of the Burn, and in open woodlands of every kind. It is one of the birds whose preferences for timber lead them into the virgin forest, but there they require a "margin" of some sort, usually a brook or a bog, which breaks the forest canopy in some degree. Though it nests most commonly in sapling growth it hunts and sings in the trees, preferably such as form spreading tops at medium height, but it has little to do with evergreens. At Barber Point a pair of Red-eyed Vireos nested about six feet from the ground in a drooping fork of a maple, amid blackberry and raspberry bushes; another pair had a similar nest in a small beech in the edge of the open woods; and a third was in a small maple in a bushy clearing, near the lakeshore. The nests of all the vireos are much alike,—cups of bark and spider-silk hung beneath a horizontal fork. The Red-eyed Vireo is a jealous watcher over the space about its nest, and it manifests an especial dislike for the presence of a Grackle in the trees near its home, scolding and trying to drive it away.

***MIGRANT SHRIKE.** *Lanius ludovicianus migrans* W. Palmer

No Shrike was seen at Cranberry Lake; but this species may be noted there in future, for Eaton finds that it is a fairly common breeder in western and central New York, in the Black River Valley, Mohawk Valley, and around the outskirts of the Adirondacks.

He also says ('14, p. 364) that it has gradually increased in numbers since the clearing of the country.

CEDAR WAXWING; CEDAR-BIRD. *Bombycilla cedrorum* Vieill.

Length 7.2. Head and throat snuff-brown, becoming grayish on back and breast; head crested; under parts yellowish; end of tail yellow; quills of wings and tail often tipped with red sealing-wax-like points.

The Cedar Waxwing frequents all aspects of the wooded regions except the virgin forest, but is usually attracted more by shrubbery than by large trees. It uses the tall trees principally as stations from which to sally out and capture flying insects, and in this it rivals the true flycatchers in ability. The Cedar-bird is noted for its taste for fruits and berries, and wherever it finds these in the woods, burns and clearings, there it establishes itself for the breeding season. This breadth of fare gives the Waxwing a wide range of habitat and in the Adirondack region it has merely to settle down in the midst of plenty.

It is a late breeder. A pair at Barber Point selected a site in a small beech on the campus, choosing a horizontal fork screened by foliage above and below. They began to construct the nest on the first day of July, both birds taking part in the work, the male accompanying the female in her trips for nest material. His share of the building operations was to carry the short slender twigs used in the framework of the nest, while the female brought the moss and lichens for its thick walls. The female did all the work in shaping up the walls and in weaving the twigs and moss together, and as she sat in the structure at this labor the male usually stood on the rim of the nest. On July 10 this nest was complete and on August 9 the young birds left it, measuring a period of forty days. Several other nests were made on the campus, and one was in an open part of the bog, on a horizontal branch of a small scraggy spruce. This nest was composed chiefly of moss or lichen, similar in construction to many that I had examined in Montana, and was the only nest of this species that I ever found in a spruce. One other nest of the Cedar Waxwing deserves mention, for it was in a willow sapling admirably concealed in a mixed clump of willow and aspen, and was a good illustration of the value of the aspen in the Burn association in its relation to the nesting habits of birds.

The Cedar Waxwings begin to make their appearance in the woods and clearings with the flowering of the berry bushes. They associate in small flocks at this time, and frequently a troop of them will be startled from a small area of blackberry bushes, where they have been eating the blossoms or embryo fruits. They feed eagerly on stamens and pistils of the blackberry blooms, and from this time they find the woods and berry patches a storehouse of wild-wood supplies. No bird of the Great North Woods has a keener appetite for wild fruits than the Cedar Waxwing, and it has in the Adirondacks an unlimited orchard of nature's choicest undomesticated berries.

ROUGH-WINGED SWALLOW. *Stelgidopteryx serripennis* (Aud.)

Length 5.7. Dark brown above; throat and breast *brownish gray*; belly white.

The Rough-winged Swallow occurs in small numbers in the western Adirondack region. A pair nested in an iron pipe at a boat-landing near Barber Point. Posson ('90, pp. 107-108) reports that in Orleans County it is a summer resident that may be depended upon, its favored nesting locations being crevices of the stonework under bridges. Occasionally a few will nest in a sandy bank with the Bank Swallows.

BANK SWALLOW. *Riparia riparia* (Linn.)

Length 5.2. Grayish brown above; white below; narrow, but distinct *brownish band across breast*.

The Bank Swallow occurs locally at Cranberry Lake. An open face of sand, steep, and fifteen feet or more in height, facing a piece of water, will attract this swallow to colonize, for it delights to hunt over still water and will also course low over a line of alders fringing a level rivulet, foraging for insects that rise from the stagnant pools. A small colony nested near the Point. The really "good times" in their experiences came when the young were getting a-wing, for those were the days when the juveniles were trained in all the arts of flight, insect catching, nest construction, self-support, and community life in general. I hold the view that with most birds the post-nesting period of the summer, particularly the time between leaving the nest and when the adults cease to manifest the parental instincts, is devoted to a more thorough training of the young than the birds are usually credited with; and that this accounts for the peculiar actions observable in the relations of adults and juvenile birds at that season. The flying young of the Bank Swallow are induced to stop in their evolutions and cling to the face of the bank containing their nests. My first thought was that the youngsters, tired of their circling over the water, were stopping to rest; but the elders were leaders in these movements, and I suspect the purpose was to start the juveniles at digging in the bank as a suggestion for the manner of nest construction another year. Another trick of the elders was to alight with the juveniles on bare open ground for the purpose of picking up fragments of light grass stems to carry away; as the season for nest building had passed, it seems that such actions were to initiate the youngsters into the art of nest building.

Allen ('03, p. 149) says: "This is the first of our swallows to leave, and among the White Mountain valleys the breeding colonies break up and disappear by the middle of July." This is much earlier than in the western Adirondacks, for the Bank Swallows at Barber Point remained at least until my observations ended about August 20, though the numbers were not so noticeable as when all the families were on the wing several weeks earlier. It appears that there is a gradual thinning out of the numbers by individuals join-

ing themselves to flocks gradually enlarging in the chosen roosting-places until the time for the autumnal departure southward.

TREE SWALLOW. *Iridoprocne bicolor* (Vieill.)

Length 6. Steel-blue or steel-green above; white below.

The Swallow is always associated with tall dead timber on the margins of lakes, ponds, or inlets, or in a burn. As it nests most frequently in woodpecker holes in dead stubs and snags, it finds many places inviting its presence throughout the Adirondacks. It may regularly be noted coursing over the clearings, burns and ponds, in its ceaseless quest for insects in company with the Chimney Swift or Bank Swallow, and sometimes gleans in the dooryard regardless of other occupants.

BARN SWALLOW. *Hirundo erythrogastra* Bodd.

Length 7. Above, blue-black; forehead and upper breast chestnut; belly paler; tail deeply forked.

The Barn Swallow chooses a combination of still water and pastureland over which it can quarter in persistent evolutions. These, and a building made for domestic animals, will influence it to establish itself locally for the summer. It was seen by me at Wanakena and at Cranberry Lake village but not at Barber Point, yet its distribution in the Adirondacks is very general. Its nests of mud, straw and feathers are always placed *inside* the barn chosen, and its elongated white eggs are marked with red about the larger end.

* CLIFF SWALLOW. *Petrochelidon lunifrons lunifrons* (Say)

The Cliff Swallow was not observed by me at Cranberry Lake in 1916. Merriam ('81, p. 229) reports that it "breeds at suitable localities in the Adirondacks." Roosevelt, Jr., and Minot ('77, p. 2) mention it as occurring near Malone. Eaton ('14, p. 345) says that "in New York it is known locally throughout the State, but in many sections where it was very common 40 years ago it has almost entirely disappeared. At the present time it seems to be commonest in the Catskill and Adirondack districts and other sparsely inhabited sections of the State." It much resembles the Barn Swallow, but has a reddish buff patch on the rump, and a *square-ended tail*. Its nests are the flask-shaped structures glued under the eaves on the *outside* of farm buildings, hence it is commonly called Eave Swallow.

SCARLET TANAGER. *Piranga erythromelas* Vieill.

Length 7.5. Male, scarlet, with black wings and tail; female and young olive-green, with brown wings and tail.

Where tall hardwoods stand in illuminated patches (the so-called hardwood ridges) or along the borders of timber broken by streams and shores, there the Scarlet Tanager sings in the leafy canopy and makes its summer home. It loves the sunlight, and can be seen most frequently in an open tree top, either uttering its nervous, impatient songs or its *chip-chuur* call to its mate. The singing of the Scarlet Tanager is so close an imitation of the Robin's that many persons

overlook the bird's presence. Its songs, however, are quite distinctive, being repeated more hurriedly and nervously than the Robin's, with a somewhat harsher quality, nor do they have the higher and lower modulations characterizing the Robin's songs, nor the squeaking interpolations. The Tanager travels over more ground than the Robin in its morning recitals, for the latter sits in one place and sings repeatedly; but the Tanager moves restlessly from one station to another and from one tree to another, often for a considerable distance. In the Barber Point neighborhood a pair of Scarlet Tanagers nested in the dry open woods on a ridge from which the conifers had been lumbered many years before. The site of the nest was a drooping horizontal branch in a large maple, on a fork about ten feet from the trunk and about twenty feet from the ground. The *chip-chuur* of the male was heard when he was at a considerable distance from the nest, and by slowly following his call as he finally went to the nest, I was enabled to discover his home. Both parents were feeding the nestlings.

* INDIGO-BIRD. *Passerina cyanea* (Linn.)

Length 5.4. Male deep blue, darker on head; female brown above, faintly streaked.

The Indigo-bird was not seen by me at Cranberry Lake in 1916. This species should become more common with the extension of the clearings, especially those with the agricultural or domestic associations, as it is one of the birds noticeably enlarging their range within the general limits of definite vegetation associations.

ROSE-BREADED GROSBEAK. *Zamelodia ludoviciana* (Linn.)

Length 8. Head, throat, back, wings and tail black; lower parts, rump and wing-bars white; under wing coverts and *breast rose-red*; female streaked brown above, whitish below, with a white line over eye.

The Rose-breasted Grosbeak dwells in clearings, preferably in the shrubbery and sapling growth about old mill sites, and on the borders of burns near streams. This species has little to do with mature woodlands, and berry patches are the most potent factor in its occurrence in the Adirondack Park, at least during the fruit season, for it is as eager in its attendance on these as are the Robin and the Catbird. At Barber Point this grosbeak nested in the Partial and Habitation Clearings, along with the Catbird and other birds of the bush. In the early spring it haunts the foliage of maple and beech, singing, hunting for insects, and eating the tender buds. After the song season, when the elders have charge of the juveniles on the wing, the sharp *chick* call of this Grosbeak will often be heard.

LINCOLN'S SPARROW. *Melospiza lincolni lincolni* (Aud.)

Length 5.7. Grayish brown streaked with black and chestnut; center of crown a gray stripe; *buff band across breast*; sides black-streaked, belly white.

A small colony of Lincoln's Sparrows inhabited the Bog, where perhaps four pairs were nesting, but it was not met with elsewhere.

This sparrow was active in the open parts of the Bog, where were only a few living trees, the most of the vegetation being small second-growth and heath shrubs springing from a sphagnum carpet. It was the strange outburst of song, uttered only occasionally, and usually when the male came from the nest and alighted in the lower branches of a larger tree, that aroused my attention to the fact that I had to deal with something not a Song Sparrow, and its identification quickly followed. Lincoln's Sparrow is much shyer and warier than the Song Sparrow, and keeps at a distance from observation; moreover, it utilizes the lower portions of the trees more than the Song Sparrow, and seems not to be a bird of the bushes nor of the shoreline shrubbery, as the Song Sparrow is, though its foraging for food is chiefly in low shrubs.

The singing of the Lincoln's Sparrow is very different from any of the Song Sparrow's performances. The general song consists of three parts or series of notes. At first it sounded like a strange warbler song; later I classed it as a wren-like performance introduced by several sparrow notes and ending with a jingle like a Meadowlark's or Towhee's. The three sets of movements will serve to distinguish the singing of Lincoln's Sparrow from that of the Song Sparrow or the White-throat when all these birds are inhabiting the same bog.

The actions and calls of these three sparrows when disturbed in nesting or feeding their young are also very distinctive and different. The White-throat and the Song Sparrow will chirp anxiously near the nest or at the disturber when danger threatens the nest or young, but the Lincoln's Sparrow will skulk silently and secretively in the neighborhood, making little outcry and furtively watching the course of events. The White-throated Sparrow utters a nervous *clink* marked by a metallic quality, and the Song Sparrow manifests its alarm by a scolding *tschick* in an explosive tone; but the Lincoln Sparrow hides behind a convenient clump of saplings and keeps quiet, leaving its young to do the squalling. Once this summer I chanced to be in the Bog when three fledglings of the Lincoln's Sparrow left the nest, and I was at once attracted to the spot by their harsh cries. No adults were visible when I reached the place, and the young squalled persistently as they perched low among the shrub stems waiting for the adults to visit them with food. It was in a spot where alders clustered, and the insect pests of the swamp hovered around me, but I determined to watch the proceedings for a while. For many minutes I waited, wiping off mosquitoes and "punkies" and other hungry minutiae, but during the time I heard nothing of the parent birds. Frequently one or another of the youngsters would slip out of my sight for a moment, and then I could hear a chirping of satisfaction from the young one not in view, and I knew one of the adults had slipped in and fed the bird without my noticing it. The three youngsters would scatter just enough to prevent my seeing them all at one time, and then in spite of my vigilance I would miss seeing the parent feed one or another of

them. I could determine by the actions of the young that a parent was near by, and the fledgling knew it somehow, though the old birds uttered no call or chirp. To all appearances the parents were ignoring the squalling babes, and during the hour that I permitted myself to be tortured by the bog pests they gave no sign of anxiety or alarm over the fate of their young.

At length I found a way to get a view of the adult, for, after feeding one of the brood, the parent would fly out of the thicket and alight low in a sapling or shrub at the outskirts of the covert where the young were hiding, stopping only momentarily and then hurrying away for a fresh morsel of food. The cry of the young Lincoln Sparrow is a loud chirp, not like that of any other sparrow in the region, and sounds more like the cry of a nestling Sapsucker. It seemed to care nothing about my proximity. Sometimes when its young are hiding in an open spot the adult will perch in view in the lower branches of a tree and utter a low *tchup*, quite different from that of the Song Sparrow; in most cases, though, the parent will lurk just out of sight of the observer.

SONG SPARROW. *Melospiza melodia melodia* (Wils.)

Length 6.2. Reddish brown and gray with black streaks; breast darkly streaked, with a *central cluster conspicuous*; head striped.

The Song Sparrow has a wide local range, including clearings of all kinds, the Burn, and the borders of the woods. It is particularly associated with shrubbery near still water. The dry Meadow, rankly overgrown with grass waist high and intermingled berry bushes, with a slow-running brook at one side fringed with alders was here its favorite habitat, and with the Yellow-throat, it fairly monopolized the area. The Song Sparrow nests freely near buildings and camps. Once this summer at Barber Point some young fir branches were cut and heaped back of a tent to be used for a sleeping bunk, but, being left unused, a nest of the Song Sparrow with three eggs was soon made in it, within arm's length of the tent. Another nest was in a tuft of grass at the base of a small blackberry bush, at the edge of the campus near the wharf.

SLATE-COLORED JUNCO; SNOWBIRD. *Junco hyemalis hyemalis* (Linn.)

Length 6.2. Head and back slate-gray; breast and sides somewhat lighter; belly and *outer tail-feathers* white.

The Slate-colored Junco is at home in all the woodland of the Adirondack region. A favorite location for its nest is among the root fibers of an overturned tree, and hence woods, as in a burn with occasional fallen trees, afford the Junco a desirable habitat. Another Junco haunt is a slope of terraced rock overgrown with moss and supporting a growth of spruce and fir, as is common in ravines.

The Junco is remarkably versatile in its adaptability to conditions, and understands the art of making itself at home in many varying circumstances. In the summer of 1916 a pair made a nest in the side



Drawn by Edmund J. Sawyer

PLATE 33. BIRDS OF THE VIRGIN ADIRONDACK MIXED FOREST

1, Hermit Thrush.
2, Winter Wren.

3, Red-breasted Nuthatch.
4, 5, Golden-crowned Kinglet
(male and female).

of a slight mound of earth on the open campus at Barber Point, exposed to the eyes of persons in the tents not more than twenty feet away; and the male would forage industriously while his spouse sat in the little nest, and would glean near the back door of the cook-house as unconcernedly as the Chipping Sparrow or a Crossbill. Some mustard plants had made a squatter's claim near the kitchen, and the Junco frequently pecked at the mustard blooms. He would flutter up from the ground, pull at the flowers, and nip off portions of the stamens and pistils. While these Juncos were feeding their young in the nest, they pecked one morning at an old rain-soaked biscuit that had been thrown under a tree on the campus. A pair of Bronzed Grackles feeding young at the water's edge by the brook inlet also discovered the biscuit and recognized its value as ready-made food for their nestlings; and for a half day this product of the kitchen served as a center of activity for both Juncos and Grackles. There were four eggs in this Junco's nest; they hatched out on July 2, and on July 13 the young departed. It is worth while to note that one infertile egg was left in the nest, as happened in the case of a White-throated Sparrow's and also an Olive-backed Thrush's nest in the neighborhood.

* FIELD SPARROW. *Spizella pusilla pusilla* (Wils.)

The Field Sparrow was not seen at Cranberry Lake by me in the season of 1916, and according to Eaton is decidedly less common than the Chippy in the northern part of the state.

CHIPPING SPARROW. *Spizella passerina passerina* (Bech.)

Length 5.3. Streaked reddish and gray above; light-gray below; breast unspotted; cap reddish.

The Chipping Sparrow does not get far from human habitations. At Barber Point a pair lived in the Partial Clearing, and spent their time chiefly about the door of the cook-house and in the trees of the campus. The male of this pair had two favorite song stations, one on dead branches well up in one of the white birches, and the other on a dead branch of a large maple in the middle of the campus, about fifty yards away. He would sing from one of these stations for a while, then fly to the other for another recital; or perhaps he would sport about the Camp with the female, or glean for a time at the dooryard, and then seek one of these song stations for his musical performance. Another pair of Chipping Sparrows had a home in bushes in the meadow near the edge of the Burn.

WHITE-THROATED SPARROW. *Zonotrichia albicollis* (Gmel.)

Length 6.7. Brown-streaked above; gray, unspotted, below; throat brightly white; crown black, center a narrow white stripe, with a strong black stripe on each side, then a white stripe over and behind the eye; yellow spot before each eye.

The White-throated Sparrow is common in clearings of all kinds, especially in the Burn and the Bog. Kells ('89, p. 184), writing from the experience of a veteran collector, says: "The range of this

species is confined to tracts of low, swampy ground, or the margins of brush-littered woods, where there is an intermingling of low brushwood, creeping vines, tall grasses and fallen timber; but the half-burnt swamps are its peculiar home, from the early days of April until the advent of autumn; and here through all the summer-time its clear, loud whistling song is among the most conspicuous of all the bird melody that affects the otherwise unpleasant scenery." A bog or a burn are particularly desirable habitats for the White-throated Sparrow because of its fondness for berries. Judd ('01, p. 74) mentions some of the leading fruits sought for by the White-throat in summer, with the statement that "from July to November, inclusive, one-fourth of its food consists of berries." In the Adirondack plateau it eats such fruits as blueberry, wild cherry, mountain ash, sarsaparilla, elder, blackberry, dogwood and cranberry. Other kinds of food, however, are eaten by the White-throat. Once this summer I observed an adult of this sparrow while gathering food for its nestlings enter the open end of a decayed log lying obliquely on the sphagnum. As the sparrow already had quite a mouthful of insect larvae it had gathered from the moss, I pondered the reason for its entering the log. Upon inspecting the open cavity, however, after the bird had quickly emerged from the interior, I found a colony of large black ants just inside the opening, and I inferred that the Sparrow had added a nice juicy ant as a tidbit to the supply it was carrying home. On another occasion I surprised an adult White-throat foraging among aspens fringing the Burn, and it flew to a perch near me with a large green caterpillar in its mouth. On being disturbed unexpectedly, however, as it had not obtained a firm hold upon its victim, the latter dropped to the ground. The sparrow quickly flew down to recover its prize, but before it could get it, I had myself captured it as a specimen of White-throat diet.

This is one of the commonest of the breeding birds at Cranberry Lake, but is so artful in concealing its nest that to find the exact location frequently baffles the keenest observer. I have often hunted persistently for nests of this sparrow without success, and at other times chanced on a nest by mere accident. A nest of the White-throat at Barber Point was made in a low raspberry bush among enveloping low shrubs just beside a narrow trail used every day through the Habitation Clearing. The nest was not found until July 24, for it was at a place where a survey party had lopped off some saplings and thrown them beside the trail; under this partial screen the White-throats constructed their home in the bush, so carefully concealed and so quietly made that it was not discovered until the female was sitting closely on her eggs. As the date was rather late, and the nest complement in this case only three eggs, this was probably an instance of second nesting; moreover, one of the three eggs was infertile, and only two young left the nest. During the construction of this nest, and while the female was sitting, there was no indication by the singing of the male near by that a nest was at hand, for to my knowledge he never

sang nearer than fifty yards from the site. After the young came out of the nest the entire family disappeared. This nest was a bulky structure of coarse weed stems and joints of dried grasses, with fibrous rootlets interwoven, and a lining of fine rootlets and wiry grasses.

*SAVANNAH SPARROW. *Passerculus sandwichensis savanna* (Wils.)

The Savannah Sparrow was not observed at Cranberry Lake by me in the season of 1916, although Eaton ('14, p. 288) states that it is a "common summer resident throughout central and western New York and in the Adirondack district." It is distinguished by a bright yellow spot before the eye.

*VESPER SPARROW. *Poæcetes gramineus gramineus* (Gmel.)

The Vesper Sparrow was not observed at Cranberry Lake by me in 1916, but it was noted at Barber Point in 1915 by Prof. L. H. Pennington. Merriam ('81, p. 229) mentions it as common in "dry grass-covered clearings and sandy fields." Eaton ('14, p. 285) reports that "this sparrow is a common summer resident in all portions of the state." Its white outer tail-feathers, conspicuous in flight, are its mark of easy recognition.

*PINE SISKIN. *Spinus pinus* (Wils.)

The Pine Siskin was not seen by me. I fully expected to meet it in the western Adirondacks, for in the forest region of Montana the Pine Siskin associates so intimately with the American Crossbill that it seems peculiar to find the latter occurring commonly without the former. The supply of tamarack cones seems to be a leading factor in influencing their presence in the woods, together with the hemlock seed crop; and 1916 may have been a season which such attractions were lacking in the Adirondack bill-of-fare.

GOLDFINCH. *Astragalinus tristis tristis* (Linn.)

Length 5.1. Male, rich yellow, with black cap; wings and tail black, spotted with white; female olive-brown above, buffy below; wings and tail dusky.

The Goldfinch is a noticeable inhabitant of the Habitation Clearing and the Burn. It manifests a preference for human associations, and at Barber Point it came freely into the trees in the open campus, being attracted particularly by the seed-bearing white birches. During the later part of July and through August the Goldfinch resorted to the birches to feed upon the ripened seeds; often only a single pair frequented the birches, and early in the morning and at evening the male Goldfinch would perch in the top of a tall maple on the campus and utter his nuptial songs. Most commonly the Goldfinches are heard as they fly about the locality, usually in pairs, calling in plaintive tones their *dee ee* expressions of their emotions. Open low growth, with clumps of saplings and shrubbery, preferably with a trace of human surroundings, constitutes the favorite habitat

of this bird. The great natural cherry orchards of the moist burned tracts form an unlimited area where the Goldfinches roam in summer and rear their broods. A pair made a nest in a small birch sapling near a trail through the Habitation Clearing. The sapling was standing alone, and the site was a fork about five feet from the ground. During the construction of the nest the birds are quite noticeable by their *dee ee* calls; and the nest itself may usually be found by searching the saplings where they are heard calling during the breeding period. This nest was within twenty feet of an old stub containing a nest of a House Wren, and not far from a spot where a pair of White-throated Sparrows were nesting along the same trail. The pair of Goldfinches began work on their nest about July 14; the first egg was deposited on July 21, and on July 27 there were six eggs in the nest; the young were crowding the nest on August 18, and they left it soon after August 20.

WHITE-WINGED CROSSBILL. *Loxia leucoptera* Gmel.

Length 6. Male, rose-pink, middle of back black; *two white wing-bars*. Female, olive-green and dusky; rump and under surface yellowish.

A single specimen was seen in the open top of a tall tamarack in the Bog on July 27. Generally, where Common Crossbills are regularly found, the White-winged occurs with them in proportions of one of the latter to ten or twelve of the former.

COMMON CROSSBILL. *Loxia curvirostra minor* (Brehm)

Length 6.1. Red, mixed with greenish and yellow; female olive-green and yellowish.

This Crossbill was seen and heard every day, often only a pair or a group of four or five, and once a flock of twelve or fifteen. The seeds of the white birch appeared to be their principal food after the cones began to ripen. It seemed as if their visits to the campus in the early part of June was to inspect the condition of the birch seeds, and to determine whether there was to be an available supply. A pair would swing into the trees, utter their *quit-quit* calls and soon restlessly take flight for another neighborhood. Sometimes a small family, apparently two adults and two juveniles, would visit the trees, and this group was the most regularly noticed about the campus. Frequently they would scatter, and one or two of them would alight at the back door of the cook-house or in front of one of the tents, gleaning from the sweepings. As the birch seeds progressed to ripeness, the Crossbills would spend more time in the trees, generally feeding so quietly that their presence would be unobserved except as an occasional flutter of wings, or a low *quit* of satisfaction, would reveal their operations, as they feasted on the seeds. Later in the season the Crossbills were joined by a pair or two of Goldfinches and several Purple Finches, all feeding more or less in the birches. On the basis of the observations of these four white birches on the campus, I should estimate that at least one family of Crossbills in the neighborhood, one of Goldfinches and one of Purple Finches, were supported during the month from

July 20 to August 20 chiefly by the seeds of these birches. The Crossbills eat the seeds from the birch catkins in two different ways. Sometimes they cling to the terminal twigs where the cones are attached and bite out mouthfuls of seeds, often standing with head down in their endeavors to reach the catkins, and detaching seeds with their crossed, forcep-like mandibles, and many seeds fall wasted to the ground. Usually, however, they bite off the cones one at a time, holding each against a branch with their feet, and munch on it in a leisurely manner. The Crossbills are the only birds I have observed that have this habit of breaking off the catkins and holding them underfoot as they bite out mouthfuls of seeds. Mrs. Miller ('04, p. 8), however, mentions this action of these birds in their feeding, where she says: "The Crossbills were the most restless, as well as the most noisy of birds, appearing before my window a dozen times a day, sometimes staying but a few minutes, sometimes perhaps half an hour, biting off the cones, holding them under one foot and extracting the seeds in eager haste."

The Crossbills build their nests in evergreens, making a substantial structure of cedar bark, dried grass, and stems of the Norway spruce, lined with horsehair, feathers, dried grass and fibrous roots.

PURPLE FINCH. *Carpodacus purpureus purpureus* (Gmel.)

Length 6.2. Dull rose-red, brightest about the head; back brownish; belly white. Female grayish brown, streaked below.

The Purple Finch is a frequenter of the forest margins of the Bog and the clearings. It does not appear to get into the dense woods nor among the lumbered timber of the ridges. It also favors the minor growth near the water margins of the lumbered localities, and the Habitation Clearing is one of its preferred habitats. It is a restless creature, like the Crossbill, except when feeding, and scarcely gets well alighted before it is up and away again. The song of this finch resembles that of the Warbling Vireo, though the former's efforts are uttered singly and with such frequent change of station that no mistake is likely to be made. The Purple Finch frequently came about the dooryard or the space near the tents, but was shyer than the Crossbill. It associates occasionally with the Crossbills and Goldfinches in feeding on the seeds of the white birch.

BRONZED GRACKLE. *Quiscalus quiscula æneus* Ridgw.

Length 12. Head purple or steel-green or steel-blue; back and belly bronze; no iridescent bars.

The Bronzed Grackle is generally associated with the Camp or the Habitation Clearing, for it likes to frequent the trees of a dooryard, though in the western Adirondack region it nests most frequently in the cavities of broken dead snags. Cranberry Lake is noted for its extended inlets, along whose shores stand dead stubs and snags; and the Crow Blackbird makes such places its resort, especially if there are buildings in the vicinity. As soon as its young are on the wing the Grackle forsakes its nesting place and allies itself with other blackbirds flocking together in the swamps preparatory to their early departure for the autumn grainfields.

Concerning the small numbers of Bronzed Grackles in the Adirondack plateau, it must be kept in mind that there is little cultivated land. Herein I find perhaps the most powerful influence operating to restrict the relative representation of this Grackle. The scarcity of snails along the Adirondack lakeshores and streambanks is also worth consideration. Where a water-line abounds in snails, the Grackle tenants the neighborhood to a greater degree than where this food element is lacking. I have frequently watched a Grackle in central Illinois search from fifty to a hundred feet of riverbank until it found a snail in suitable condition at the water's edge, and then fly away with it across a mile of water to feed its young in the nest on the opposite bank, making such trips many times in the day. The literature to which I have had access does not emphasize mollusks as Grackles' food. Beal ('00, p. 63) does not show that snails constitute more than a small percentage of the Grackle's food. I am certain that nestlings of the Bronzed Grackle in the bottom-lands of the Illinois River are fed liberally on such common snails as are washed ashore at the water-level.

RUSTY BLACKBIRD. *Euphagus carolinus* (Müll.)

Length 9.5. Greenish black, the feathers sometimes with rusty edgings. Female, slaty-gray.

The Rusty Blackbird inhabits the low bushes with the alders in or along the borders of the grassy Meadow, where the few tall dead snags furnish them with convenient stations or lookouts. The Rusty Blackbird looks much like the Red-winged Blackbird minus the red markings of the shoulders. Moreover, its customary call of *cong ree* is much like the effort of the Red-wing, though, as uttered by the Rusty Blackbird, the call is more nearly in two parts than in three, like the Red-wing's. This species forages largely in the bases of the alders, getting a desirable food supply from the insect life of the stagnant shallow water in which the alders stand. In its association with arborescent shrubs and low bushes, the Rusty Blackbird is somewhat different from the Red-wing, as the latter resorts more to the grass of the swamp in its foraging.

* BALTIMORE ORIOLE. *Icterus galbula* (Linn.)

The Baltimore Oriole was not seen at Cranberry Lake by me in 1916. Eaton ('14, p. 237) says: "It is a common summer resident of all New York State with the exception of the wooded portions of the Catskills and Adirondacks, but enters the river valleys and cleared lands of the Adirondacks."

RED-WINGED BLACKBIRD. *Agelaius phœniceus phœniceus* (Linn.)

Length 9.5. Male black; upper part of wing broadly scarlet edged with yellow and white. Female brown and streaked.

The Red-winged Blackbird was observed by me at Cranberry Lake in only one habitat, the floating bog islands. These are common in various inlets, usually near the shore. They consist of submerged sphagnum as a foundation for a mat of mixed bog shrubs so inter-

mingled as to form a support strong enough to hold up a man in walking over it, though the whole mass will float when driven by a strong wind. Frequently a colony of Red-wings of considerable size would be associated with one of these islands.

* COWBIRD. *Molothrus ater ater* (Bodd.)

The Cowbird was not seen at Cranberry Lake in 1916. Eaton ('14, pp. 225-226) says of it: "It is altogether too common a summer resident in all portions of the State up to the beginning of the Canadian zone, but it also invades the valleys and cleared lands of the Adirondacks to the farthest edge of the Alleghanian area in that district."

CROW. *Corvus brachyrhynchos brachyrhynchos* Brehm

At Cranberry Lake I never heard the Crow except along Sucker Brook or near one of the inlets opening into the lake, and never more than one was seen or heard at any observation, the individuals seeming to live a solitary life.

* NORTHERN RAVEN. *Corvus corax principalis* Ridgw.

I did not see a Raven. Eaton ('14, p. 212) states that "at the present time a few may be seen in the western Adirondack region, especially in the northern portions of Hamilton and Herkimer counties, the southern portion of St. Lawrence County and the eastern portion of Lewis county."

* CANADA JAY. *Perisoreus canadensis canadensis* (Linn.)

The Canada Jay was not observed at Cranberry Lake by me in 1916. Roosevelt and Minot ('77, p. 3) report it as "locally common in the thicker woods." Eaton ('14, p. 210) says that it "is confined to the Adirondack district and is scarcely if ever, seen outside the spruce and balsam belt."

BLUE JAY. *Cyanocitta cristata cristata* (Linn.)

Length 11.7. Crested; above gray-blue; lower surface grayish and white; corners of tail white.

The Blue Jay frequents the margins of the forest along the stream valleys, preferably where a brook skirts an ancient stream bed so that the level stretches make an open margin in the thick woods. The Blue Jay also resorts to any burn, if there are scattered or separate trees of medium size, the beech being favored as a producer of nuts; and it also patronizes the open portions of the Bog, using the tall tree remnants as lookouts for its foraging excursions. Blue Jays ordinarily associate in little parties of two or three, after the young are on the wing, or perhaps an entire family will forage together. One will perhaps fly ahead, and then another may presently follow over the same line of flight, usually keeping above the forest in flying from one station to another. Once this summer I saw a troop of ten cross the bog in this way, one at a time, all keeping in the same general direction, and each calling loudly and stopping in about the same place in the woods where the leader had stopped.

According to Forbush ('13, p. 369): "The well-known Blue Jay (*Cyanocitta cristata*) is destructive to the eggs of the smaller birds, whose nests it robs systematically, and it has frequently been seen to kill the young. The Robin and other larger birds will drive the Jay away from their nests, but it often succeeds in robbing them by stealth. Vireos, warblers, and sparrows it regards very little, and plunders their nests without noticing their agonized cries. Jays and Crows together sometimes make it very difficult for other birds to raise any young."

PRAIRIE HORNED LARK. *Otocoris alpestris praticola* Hensh.

Length 7.7. Above brownish, streaked; throat and sides of head yellow; broad stripe from bill down sides of throat and the breast black; *black feathers over each eye prolonged into little "horns"*; lower surface white.

The Prairie Horned Lark was seen at Cranberry Lake by me in 1916, on only one occasion, when a pair visited the bare tennis court of the open campus on the morning of July 25, and pecked over the sandy area. When disturbed, they arose in the well-known mounting flight peculiar to the larks, rising by stages until above the trees near by and thence flying across the lake toward the north. Prof. L. H. Pennington includes this variety of the Horned Lark in his manuscript list of birds of Cranberry Lake.

LEAST FLYCATCHER. *Empidonax minimus* (W. M. & S. F. Baird)

Length 5.4. Above brownish green; wing-bars light buff; below white, grayish on breast, sides tinged with yellow; *tail slightly forked*.

The Least Flycatcher inhabits the clearings and avoids the real woods. It likes the sapling growth, especially of maple and birch, in the Burn, where it sets its nest in an upright crotch and whence it can dash out over the shrubbery and snap up hovering insects. This Flycatcher goes by the name of "Chebec" in many books, copied from its call, which is represented as accented on the second syllable. To my ear the call seems always accented on the *first* syllable, sounding somewhat like *see-vick*; and I cannot write it otherwise. G. M. Allen ('03, p. 122) remarks that "it seems to follow civilization almost as closely as the Alder Flycatcher does the alder swamps, and extends its range up the valleys with the settlements;" and adds, concerning the Chipping Sparrow: "Like the Least Flycatcher, it follows closely the path of civilization, and has doubtless greatly extended its range within historic times as the forests have disappeared before the advance of the white man." In another paper Allen makes a broad generalization as follows: "The effect of clearing off the heavy primeval forest by man in his progress up these same valleys has doubtless been to extend in great measure the transition area."

ALDER FLYCATCHER. *Empidonax trailli alnorum* Brewst.

Length 6.1. Like Least Flycatcher, but larger, and *no forking* tail.

The Alder Flycatcher is associated with well-lighted deciduous woods with a fair undergrowth of saplings and shrubbery. It

requires the minor growth, for its persistent dashes for insects are made in the spaces between the sapling clumps.

This flycatcher is usually described as retiring in its habits, but wherever I have found it in the breeding season it has impressed me as more demonstrative and aggressive than most of the other birds nesting in the same habitat. It manifests its most obvious trait as a flycatcher in its relations with its neighbors, for it is jealous of any birds that forage in the part of the ravine or thicket it frequents, and will snap vigorously at any Chestnut-sided Warbler or smaller bird happening to hunt in saplings where it is momentarily working. These exhibitions of rudeness are not because of the nearness of the intruder to its nest, for I have witnessed this flycatcher snapping at a warbler or vireo when the latter was at a considerable distance from the flycatcher's home.

In another characteristic not generally known this flycatcher is singular, for it has two styles of nest location, and frequently evades detection of its nest because the observer seeks in the better-known situations. It commonly finds a site in an upright crotch of a bush or sapling, but in some instances it saddles its nest on a horizontal branch from twenty to thirty feet from the ground. As a rule, if it selects a site in a bush or sapling, the nest is made in an upright crotch; but if a tree is chosen as the situation, the nest is saddled on one of the horizontal branches rather high from the ground but low in the branching portion of the tree. I have found more nests of the Alder Flycatcher in the middle story of the woods than in the bush-sapling zone, somewhat like the nesting locations of the Acadian Flycatcher. In another respect the Alder Flycatcher differs from the Least Flycatcher and the Wood Pewee, with both of which it associates to some extent; it leaves its breeding habitat soon after the young become self-supporting, and in the Adirondack region it is not noticed in voice or movements much later than the end of July, whereas the other flycatchers mentioned continue their activities in the neighborhood until late in August at least.

Eaton ('14, p. 197), in writing of the Alder Flycatcher, says that it is like the Green-crested or Acadian Flycatcher in that it usually keeps out of sight among the foliage. This is different from my own observations of the Alder Flycatcher, for it really seldom gets into the foliage, though its movements are generally screened by foliage between it and the observer. It follows the larger flycatchers in its habit of alighting on dead branches or bare portions of the minor growth as it forages restlessly in and out among the clumps of shrubbery in the ravine or area of bush it frequents, and most of its activities are thus carried on in the open spaces in its resorts.

The song calls of the Alder Flycatcher have received a variety of representations by different observers. J. A. Farley observes that its song consists of but one harsh explosive syllable. Allen ('02, p. 84) gives a rendition of three syllables, *wee-see-up*, with the second syllable accented and the *up* ending very faintly. Fol-

lowing the opinions of the foregoing observers, Mrs. Olive Thorne Miller ('02, p. 289) offers the following description: "The ordinary song, as I know it, consists of two notes much like the Chebec's. It is in the hoarse tone of the Phoebe, and is jerked out with a backward jerk of the head, after the manner of the Least Flycatcher, and to my ear, it sounds like *red-dy* sometimes — but not by any means generally." I am glad that Mrs. Miller suggests this representation of the call, for it appears that she recognizes the accentuation on the first syllable of the song, which to my ear, is very distinct, as in the case of the Least Flycatcher. Toward the latter part of the summer season, the Alder Flycatcher frequently expresses the exuberance of its emotions in a hurried chattering, apparently a running together of several of its customary song notes and calls, the performance constituting an attempt at musical production more ambitious than the flycatchers are usually supposed to undertake. At any rate the Alder Flycatcher, as it seeks food among the saplings, almost constantly utters its cry, resembling the syllables *cri ik* enunciated emphatically and impatiently; and in visiting its nest with food for its young, it is noisy and energetic in its chattering and scolding, like the large Flycatchers at their nests.

YELLOW-BELLIED FLYCATCHER. *Empidonax flaviventris* (W. M. & S. F. Baird)

Length 5.6. Above, *bright* olive-green; below, greenish yellow, brighter on the belly.

The Yellow-bellied Flycatcher was found at Cranberry Lake inhabiting a secluded portion of the Bog forest within a few steps of the margin where it opened upon the Burn. It was where the drainage was somewhat interrupted, causing a more prolific spot of second growth clustered with alders, and with one particular little nook of open *Sphagnum* enclosed by the typical vegetation. From that little nook in the Bog forest the dreamy call of this flycatcher lured me into its dull retreat where it was feeding its young recently from the nest as the fledglings lurked among the shaded alders. The call notes of this flycatcher consist of two syllables accented on the second, resembling the combination *puh-ee*, the second portion somewhat prolonged. It is a sweet, plaintive call, one of the sounds that make the Bog worth while, even in the face of the horde of insect pests that tormented me while I peered and ogled in my attempts to study the activities of this interesting hermit.

WOOD PEWEE. *Myiochanes virens* (Linn.)

Length 6.5. Above, dark olive, crown blackish; below dusky; throat white, belly yellowish.

The Wood Pewee inhabits the Partial Clearing and the dry open woods. For this species there should be broken woodland, with scattered mature trees, preferably hardwoods, though it does not avoid a lookout station on dead branches of a conifer. In its

chosen habitat its voice is one of the last heard in midsummer, and until late in August the plaintive calling of the Wood Pewee and the songs of the Red-eyed Vireo are the only kinds of bird music to break the monotony of the forest stillness. Like the Alder Flycatcher, the Wood Pewee, in the latter end of the breeding season, sometimes expresses its emotions in a chattering jumble of its regular song notes and calls, a performance akin to a flight song. Its nest is a cup of soft materials, set on a tree branch and covered with lichens like that of the scarcely less tiny home of the Hummingbird; and the eggs are white with a ring of spots about the larger end.

OLIVE-SIDED FLYCATCHER. *Nuttallornis borealis* (Swains.)

Length 7.4. Dark olive-gray and brown above; under parts dusky on sides, with a whitish stripe down the middle; no wing-bars.

The Olive-sided Flycatcher is one of the characteristic birds of the western Adirondack plateau, inhabiting the borders of the Virgin Forest along burns and clearings. Its lookout stations are tall dead stubs and spires in clearings near living coniferous timber, and on the top of one of these stations it perches and calls querulously, making frequent sallies into the air in pursuit of flying insects, and then returning to its station or to another similar lookout. Its loud calls are a familiar sound along the forest margins. To my mind the usual call resembles the syllables *gree deal* accented on the second; frequently there are three syllables in the call, suggesting the combination *quip gree deal*, accented on the last note of the phrase. A very frequent call of this Flycatcher contains only the *quip quip* repeated in pairs, and this constitutes the usual scolding note. Its nest is usually situated in the upper branches of a medium sized fir in the edge of the forest.

*PHŒBE. *Sayornis phæbe* (Lath.)

The Phœbe was not seen at Cranberry Lake by me, but is given in Dr. L. H. Pennington's MS. list. Eaton ('14, p. 187) says that it is probably the commonest member of the Flycatcher family, being a summer resident throughout the State except in the spruce and balsam forests of the Catskills and Adirondacks.

CRESTED FLYCATCHER. *Myiarchus crinitus* (Linn.)

Length 9. Head dark brown, somewhat crested; back olive-brown; tail reddish; throat and breast ash; belly clear yellow.

The Crested Flycatcher was found in only one habitat at Cranberry Lake, the Lumbered Clearing near the lakeshore. The family wandered widely, however, after the young were on the wing, always in open localities and generally utilizing the Burn and the cleared margins of the higher woods. Wherever it is, the Crested Flycatcher manifests its presence by its harsh cries, for, like the Kingbird, it is noisy at all times and jealous of any unwarranted intrusion of its foraging area. Only one pair of Crested Flycatchers lived in the Barber Point neighborhood, and they had

a nest in a natural cavity of a large dead maple, the site being almost over a trail through the clearing. It is interesting to note that as soon as the young could fly, the family left that particular locality, patronized the Burn more freely and went ranging throughout the open areas where tall denuded trees gave them vantage points in foraging over the clearings. Regarding the limited numbers of this flycatcher in a neighborhood, it may be suggested that their noisy habits and wide range of feeding in late summer would make them seem abundant though only one family were living there.

KINGBIRD. *Tyrannus tyrannus* (Linn.)

Length 8.5. Back gray; head blackish; the crown with a concealed spot of orange; tail black, *tipped with white*; under parts white.

The Kingbird chooses the human or domestic element for its associations, preferably near the lakeshore or a cleared inlet. It nests most frequently in the margin of an inlet, sometimes selecting a low stump surrounded by water and building its nest on the top of it; and in its guardianship of the locality the Kingbird prefers scattered trees of medium or smaller size, or else isolated clumps of trees beyond the sapling stages, from which it can keep an eye on the surroundings and sally out in jealous defense of the premises. After the young are on the wing the Kingbirds become more noisy and loquacious than before, holding many loud and demonstrative conversations with the young in the course of their training for efficient kingbird life. It appears that if there are four young, the elders will divide their charge so that one parent assumes the task of training one or two of the juveniles, and the other parent takes care of the others; and for several weeks the education of the youngsters goes on and the adult keeps in company with the juveniles, feeding them regularly and initiating them into the arts of insect catching and food selection. It appears further that the two divisions of the kingbird family resort to localities quite separated for these post-nesting activities; and further, that these two selected localities are each favorable for a home for the young another season; hence it has seemed to me that a part of all this care on the part of the adults for the young is to acquaint the juveniles with suitable nesting localities for the next season.

An interesting example of this came under my observation. A pair of Kingbirds with two young appeared on a small island in the inlet at the mouth of Sucker Brook after the nest had served its purpose. No Kingbirds had been observed there previously, except casually, but this group seemed to make the place their established headquarters for giving their young a start in life. The island was peculiar in one respect,—it was a compact exhibit of the entire vegetation of the region, a small reproduction in second growth of the typical Adirondack mixed forest. It was much used by passing birds and made a desirable lookout for foraging operations. For two or three weeks these Kingbirds lived as above described, the elders attending the young and the juveniles lazily receiving the attentions of the zealous parents, practically confining

their activities to the locality. I believe that the elders were acquainting the juveniles with the locality in order that the latter might have an available nesting place another season.

RUBY-THROATED HUMMINGBIRD. *Archilochus colubris* (Linn.)

The Ruby-throated Hummingbird is associated with almost every aspect of the forest except the primeval woods. It darts among the shrubbery of the clearings everywhere, attracted by the blossoms of the various fruit and berry shrubs and bushes. In the Partial Clearing there was a place high up on an old birch where the Yellow-bellied Sapsuckers were resorting daily for sips of sap. A pair of Hummingbirds frequented the spot, and at almost any hour of the day one or another of these hummers, or both of them, could be noted either hovering at the holes or else perched on a dead twig near at hand waiting for another taste of the contents of the sap-cups. One or more of the Sapsuckers was certain to be clinging at the most productive holes, and in that case the Hummingbird would hover at places on the other side of the tree. I never observed that the Sapsuckers made any demonstration against the Hummingbirds, though when one of the latter would dart in and find the Sapsuckers there the Hummingbird would usually withdraw and perch near by to wait for the woodpecker to shift its position at the sap holes.

Insects also, probably small flies and bees; were flying around the perforations, but neither the Hummingbird nor the Sapsuckers seemed to pay any attention to them. It was evident that the sap was the chief desideratum with these bird visitors; and usually, after taking a sip from the holes, the Hummingbird would fly away in a well defined direction through the open woods, as if to visit a nest not far off.

CHIMNEY SWIFT. *Chætura pelagica* (Linn.)

The Chimney Swift belongs to an open habitat, mainly over the land. Like the Bank Swallow the Chimney Swift seems to devote considerable attention to training its young for its aerial evolutions. Once, as they were coursing over the Burn with their young on the wing, the elders were observed to swerve into the top of a tall dead tree and touch a terminal dry twig with their feet. At first I wondered at this action, as the nest-building season was past, and the birds could have no need of the twigs. As they repeated these feats, however, it appeared to me that they were seeking to induce the juveniles to attempt the same thing, and I concluded that I was witnessing a lesson in twig gathering as a preparation for the next season's nest building.

* NIGHTHAWK. *Chordeiles virginianus virginianus* (Gmel.)

The Nighthawk was not observed at Cranberry Lake by me in 1916, but Eaton ('14, p. 167) states that it "is found in every county of the State as a summer resident, but is somewhat local in its breeding."

* WHIP-POOR-WILL. *Antrostomus vociferus vociferus* (Wils.)

The Whip-poor-will was not seen, but Eaton ('14, p. 164) says of it: "In the Adirondacks it is confined mostly to the edges of the wilderness and is not found in the depths of the spruce forests, but invades the river valleys and clearings."

NORTHERN FLICKER. *Colaptes auratus luteus* Bangs

The Flicker is commonly associated with all aspects of the forest except the dense woods. It is met with in the clearings and the Burn, along the water margins of the forest, and the open portions of the Bog. The Flicker requires principally dead timber in the form of stubs, stumps and prone logs to forage on, and large, living deciduous trees, where it can frolic with its mates. Furthermore, the Flicker needs comparatively open localities of burn or clearing where it can reach the ground in its quest for ants, for it spends much of its time searching in the humus and rotting logs for ant colonies. A considerable part of the tearing open of rotten stumps in the woods is done by Flickers. Gaige ('14, p. 82) notes that during the blueberry season the birds were flushed in numbers from the ground among the bushes, and later haunted the wild cherry trees in the same fashion. "Both fruits were favorites and the birds stayed in their vicinity until after the fruits were gone."

RED-HEADED WOODPECKER. *Melanerpes erythrocephalus* (Linn.)

Not seen at Cranberry Lake by me in 1916, but has been reported in both the western and the eastern borders of the Adirondack plateau. This woodpecker is closely associated with oaks, and hence there is little to attract it into the Adirondack mixed forest except the beech nuts, which constitute an element of its food in the lower valleys.

NORTHERN PILEATED WOODPECKER. *Phlæotomus pileatus abieticola* (Bangs)

Length 17. Black; throat, two stripes on side of head, one on neck, and wing-bar, white; top of head *crested and bright scarlet*.

The northern variety of the Pileated Woodpecker, or Logcock, was observed occasionally in dry open woods and evidences of its work were seen in the large excavations made in dead stumps. In the heavy woods where lumbering had been done in an early day and the area left to recuperate, forming a mixture of mature deciduous trees and conifers left at the early cutting, the Logcock was frequently heard, but its numbers have lessened as its original range has been invaded by the lumberman. Hoffmann ('04, p. 219) aptly characterizes the Pileated Woodpecker when he says: "It is a mighty hewer of wood, leaving signs of its activity in nearly every decaying tree and on many sound ones in its neighborhood. Where it digs for grubs, it cuts out great rectangular mortise-like holes, different from the round nesting holes of woodpeckers in general. These holes often run deep into the tree, or run into each other up and down the trunk. The noise of its hammering resounds through the woods like the blows of a woodman's axe."

YELLOW-BELLIED SAPSUCKER. *Sphyrapicus varius varius* (Linn.)

Length 8.5. Crown and throat crimson; white loop from eye cross nape to other eye; broad white stripe from bill to white under-surface; above, black and white.

The Sapsucker lives everywhere except in the denser forest, making a nest in a convenient stub, loafing at its birch sap holes and training its offspring to lead the same life of lazy satisfaction. This Sapsucker enjoys such a variety of habitats because it finds everywhere throughout the major habitat the trees which furnish it with sap and cambium. In the Burn and clearings it finds the aspen saplings which it can tap in midsummer; in open woods it has plenty of adult birches from which it can select enough for a sap-orchard; and along the streams and shores there are hemlocks in abundance upon which it can operate. A detailed account of its sap-sucking habits has already been given (see page 420).

* AMERICAN THREE-TOED WOODPECKER. *Picoides americanus americanus* Brehm

Not observed at Cranberry Lake. Eaton ('14, p. 147) says that its range is evidently confined to the Adirondack forests, it being quite uniformly distributed within the spruce and balsam forests, but less common than the Arctic Three-toed Woodpecker. It is quickly distinguishable from the Arctic by the ladder-like arrangement of white bars across the back.

ARCTIC THREE-TOED WOODPECKER. *Picoides arcticus* (Swains.)

Length 9.5. Back wholly black; top of head black, with yellow crown patch and white stripe on the side; outer tail-feathers white.

The Arctic Three-toed Woodpecker was met with in the margin between the Bog and the Virgin Forest. It is one of the shy, wary creatures of the woodland, ceasing its loud tapping when an observer approaches and clinging quietly in its place until the disturber passes. A favorite position for it in working is on the under side of an oblique stub or spire, and it generally operates on the lower half of a tree trunk. Experts testify that three-fourths of its food consists of "the direst enemies of the forest trees."

DOWNY WOODPECKER. *Dryobates pubescens medianus* (Swains.)

Length 6.8. Upper parts black; lower white; back of head scarlet in male, not in female; middle of back and wing-bars white; outer tail-quills white, barred with black.

The Downy Woodpecker frequents the clearings of every kind, but is seldom seen in the virgin forest. It gleans from aspen, birch and maple saplings; it hunts along the trunk of the smaller hemlocks and hardwood trees; or it may alight on the sturdy trunk of the largest maple, beech or birch, and pursue its investigations into the topmost branches. Occasionally a small dead stub will serve all the purposes of the Downy, and it will peck industriously for a considerable time at one promising spot until it has unearthed the object of its search. The Downy Woodpecker is very kindly disposed toward human association, and will come into a dooryard in its foraging, manifesting no fear under observation.

HAIRY WOODPECKER. *Dryobates villosus villosus* (Linn.)

Length 9.4. Larger than the Downy, and outer tail-quills *pure white*.

The Hairy Woodpecker is rather more restricted in its habitat range than the Downy, and probably is slightly less in numbers, for it is not seen quite so often. It inhabits clearings, burns and dry open woods, the margins of the Bog being apparently its most favored habitat. Like the Downy, the Hairy swings into the campus and takes a hurried inspection of a tree trunk, then it swings away to another station, its loud clear call announcing its presence. It always works nervously and impatiently.

BELTED KINGFISHER. *Ceryle alcyon alcyon* (Linn.)

Length 13. Blue and white; crested; a gray band across breast. The female has a chestnut band across belly and sides.

The Kingfisher is a frequenter of lakes and ponds wherever there are small fish for its food and suitably steep shores of sand or dirt in which it can nest. Along the brooks, also, where there are quiet pools containing small fry and convenient perching sites, the Kingfisher establishes a summer home. As a rule the pairs of Kingfishers are well distributed, for one family requires a considerable distance of shoreline for its foraging, and an adult often flies quite a distance along a water margin in making desirable captures. It is a noisy fisherman, and its loud cries are uttered most commonly after it has made a dive and flies to another station.

* GREAT HORNED OWL. *Bubo virginianus virginianus* (Gmel.)

The Great Horned Owl was not seen by me at Cranberry Lake, but it was frequently startled by the surveying parties in the deeper woods, generally in the vicinity of a lake or stream, or in the bog forests. The regular swamp woods is a favorite resort of this wilderness freebooter, and there it sleeps in seclusion during the day and thence makes its nightly forays.

Of the owls noted elsewhere in the state of New York I failed to find at Cranberry Lake the Saw-whet, Barred, Long-eared or Screech Owl. Reasons for their absence have been discussed elsewhere in this report.

BALD EAGLE. *Haliaeetus leucocephalus leucocephalus* (Linn.)

A Bald Eagle, an adult with a fine white head, lived all summer along the shores between Barber Point and Wanakena. Sometimes it was seen perched in a dead tree at the water's edge, and at other times it would be flapping slowly over the lake, or else soaring high above it and the surrounding mountains.

BROAD-WINGED HAWK. *Buteo platypterus* (Vieill.)

The Broad-winged Hawk was seen several times at Cranberry Lake. One, in juvenile plumage, on August 16, alighted in a tall dead tree, where it preened and sunned itself for many minutes, apparently unconcerned about its surroundings. A pair of Yellow-

bellied Sapsuckers frolicked in this tree top and another near by, frequently alighting near the hawk as they swung back and forth from one tree to another. A Wood Pewee was also foraging out from this same tree, and a Robin crossed the area, stopping in the tree near the hawk without apparent fear. After a while the hawk was startled by the report of a small rifle; it arose, and began soaring until it was lost high in the upper air. The Broad-winged Hawk takes the place in this region of the Red-tailed and Red-shouldered Hawks, neither of which belongs to the fauna about Cranberry Lake. Other absentees are the Goshawk, Sparrow Hawk, Cooper's Hawk and the Sharp-shinned; and the Marsh Hawk was seen but once. More to be expected, but not seen, were the Fish Hawk and the Duck Hawk.

CANADA RUFFED GROUSE. *Bonasa umbellus togata* (Linn.)

The Canadian variety of the Ruffed Grouse was met with chiefly in the borders of the woods, or in the open parts of the Burn, or on the edges of the clearings. In illuminated open bogs this grouse likes to feed in the patches of jewelweed, where it eats the succulent stems. Ordinarily in the fruit season it resorts to the Burn, where there are open spots of burned duff and soil, with blueberry and raspberry bushes for ready cover and convenient foraging. The broods are running about early in June, and thereafter the female will be found in attendance upon the youngsters as they learn the art of self-dependence in the wilderness. The drumming of the male is heard well into the summer, long after the young are under the care of the mother bird, or at least in the early days of July.

The Spruce Partridge was not found, and is now very rare in all parts of the Adirondacks.

SPOTTED SANDPIPER. *Actitis macularia* (Linn.)

Length 7.5. Brownish gray above with a faint greenish lustre, *thickly spotted* below.

The Spotted Sandpiper lives along the low inlets at various places on Cranberry Lake, preferably where there are stretches of sand beach with sparse bushes and shrubs as a background. A pair or two in each suitable locality is about all one finds in the Cranberry Lake district. This sandpiper seems to be restricted to the shores of lakes and ponds.

SOLITARY SANDPIPER. *Helodromas solitarius solitarius* (Wils.)

Length 8.5. Neck and breast streaked; sides barred; tail white, barred with black; belly white.

The Solitary Sandpiper was met with along the brook, where shallow pools are caused by the level stretches being crowded with alder growth, and is not often seen on the sand and pebble beaches. This sandpiper was not noted until early in August, and probably does not maintain a summer residence in the region.

GREAT BLUE HERON. *Ardea herodias herodias* Linn.

Great Blue Herons were seen at Cranberry Lake every day during the season of 1916, and at least one pair fed regularly between Barber Point and Wanakena. This heron frequents the flooded inlets, foraging along the low margins of the shallow water. Eaton ('10, p. 254) mentions several heronries in the Adirondack region, "the largest probably being in the vicinity of Saranac and Cranberry Lakes." If there is at present a heronry of any size near Cranberry Lake there was little evidence of it in the summer of 1916. Vague rumors of a heronry were current in the neighborhood but not half a dozen pairs of the Great Blue Heron were feeding at the Lake in 1916.

WOOD DUCK. *Aix sponsa* (Linn.)

The Wood Duck was observed several times, chiefly on secluded ponds set in the virgin woods. In these retired solitudes the Wood Duck manifests little alarm when its retreat is invaded, and without taking flight the two, which are usually in close company, paddle quietly away.

BLACK DUCK. *Anas rubripes* Brewst.

The Black Duck frequents the inlets of Cranberry Lake, and usually at least one pair would be associated with each inlet of the Lake, where they feed in the shallows of overflowed shores. Toward the end of June they would appear with their broods, leading the young to their regular quarters in the inlets and there training them to become self-dependent.

MERGANSER. *Mergus americanus* Cass.

The Merganser was seen regularly at Cranberry Lake, usually frequenting the inlets in the earlier portion of the season. After the young are taken from the nest, the adult leads them up the brooks, where they remain under parental care while learning to catch small fish. The youngsters seem quite at home in the foaming water of the rapids, and permit themselves to bob about like corks in the swift currents. The Merganser appears to resort to the brooks more than do the other ducks of the region.

HERRING GULL. *Larus argentatus* Pont.

The Herring Gull is represented at Cranberry Lake by several pairs that live on the shore between Wanakena and Barber Point. These gulls forage rather widely, and commonly follow the shoreline quite closely, looking for refuse cast up by the waves.

LOON. *Gavia immer* (Brünn.)

The Loon was represented by two pairs, at least, at the southern end of the lake. They were seen and heard every day, and their weird calls were a conspicuous feature of summer life at the lake. One pair had a nest on a small, low island near Jo Indian. The

nest was on the sloping rocky ground about three feet from the water's edge, in a spot overhung by brush so that it was partially concealed; it was made of short pieces of rootlets from the adjacent shrubs, laid together in a depression of the soil on the rock. There were two eggs in this nest, from which one young bird was hatched, and the other egg was abandoned. The pieces of root of which this nest was composed were from one-fourth to one-half an inch in diameter and from four to six or eight inches long, the whole making a very substantial framework.

List of Birds Observed Near Cranberry Lake, New York

1. Bluebird *Sialia sialis sialis* (Linn.)
2. Robin *Planesticus migratorius migratorius*
(Linn.)
3. Hermit Thrush *Hylocichla guttata pallasi* (Cab.)
4. Olive-backed Thrush *Hylocichla ustulata swainsoni*
(Tschudi)
5. Wilson's Thrush..... *Hylocichla fuscescens fuscescens*
(Steph.)
6. Golden-crowned King-
let *Regulus satrapa satrapa* Licht.
7. Chickadee *Penthestes atricapillus atricapillus*
(Linn.)
8. Red - breasted Nut-
hatch *Sitta canadensis* Linn.
9. White - breasted Nut-
hatch *Sitta carolinensis carolinensis* Lath.
10. Brown Creeper *Certhia familiaris americana* Bonap.
11. Winter Wren *Nannus hiemalis hiemalis* (Vieill.)
12. House Wren *Troglodytes ædon ædon* Vieill.
13. Brown Thrasher *Toxostoma rufum* (Linn.)
14. Catbird *Dumetella carolinensis* (Linn.)
15. Redstart *Setophaga ruticilla* (Linn.)
16. Canada Warbler *Wilsonia canadensis* (Linn.)
17. Maryland Yellow-
throat *Geothlypis trichas trichas* (Linn.)
18. Mourning Warbler .. *Oporornis philadelphia* (Wils.)
19. Water-Thrush *Sciurus noveboracensis noveboracensis*
(Gmel.)
20. Oven-bird *Sciurus aurocapillus* (Linn.)
21. Black-throated Green
Warbler *Dendroica virens* (Gmel.)
22. Blackburnian Warbler *Dendroica fusca* (Müll.)
23. Black-poll Warbler.. *Dendroica striata* (J. R. Forst.)
24. Chestnut-sided War-
bler *Dendroica pensylvanica* (Linn.)
25. Magnolia Warbler .. *Dendroica magnolia* (Wils.)
26. Myrtle Warbler..... *Dendroica coronata* (Linn.)

27. Black-throated Blue
Warbler *Dendroica cærulescens cærulescens*
(Gmel.)
28. Yellow Warbler *Dendroica æstiva æstiva* (Gmel.)
29. Northern Parula
Warbler *Compsothlypis americana pusilla* (Wils.)
30. Nashville Warbler *Vermivora ruficapilla ruficapilla* (Wils.)
31. Black and White
Warbler *Mniotilta varia* (Linn.)
32. Blue-headed Vireo *Lanius solitarius solitarius* (Wils.)
33. Warbling Vireo *Vireosylva gilva gilva* (Vieill.)
34. Red-eyed Vireo *Vireosylva olivacea* (Linn.)
35. Migrant Shrike *Lanius ludovicianus migrans* W. Palmer
36. Cedar Waxwing *Bombycilla cedrorum* Vieill.
37. Rough-winged Swallow
low *Stelgidopteryx serripennis* (Aud.)
38. Bank Swallow *Riparia riparia* (Linn.)
39. Tree Swallow *Iridoprocne bicolor* (Vieill.)
40. Barn Swallow *Hirundo erythrogastra* Bodd.
41. Cliff Swallow *Petrochelidon lunifrons lunifrons* (Say)
42. Scarlet Tanager *Piranga erythromelas* Vieill.
43. Indigo-bird *Passerina cyanea* (Linn.)
44. Rose-breasted Grosbeak
beak *Zamelodia ludoviciana* (Linn.)
45. Lincoln's Sparrow *Melospiza lincolni lincolni* (Aud.)
46. Song Sparrow *Melospiza melodia melodia* (Wils.)
47. Slate-colored Junco *Junco hyemalis hyemalis* (Linn.)
48. Field Sparrow *Spizella pusilla pusilla* (Wils.)
49. Chipping Sparrow *Spizella passerina passerina* (Bech.)
50. White-throated Sparrow
row *Zonotrichia albicollis* (Gmel.)
51. Savannah Sparrow *Passerculus sandwichensis savanna*
(Wils.)
52. Vesper Sparrow *Poæcetes gramineus gramineus* (Gmel.)
53. Pine Siskin *Spinus pinus* (Wils.)
54. Goldfinch *Astragalinus tristis tristis* (Linn.)
55. White-winged Crossbill
bill *Loxia leucoptera* Gmel.
56. Common Crossbill *Loxia curvirostra minor* (Brehm)
57. Purple Finch *Carpodacus purpureus purpureus*
(Gmel.)
58. Bronzed Grackle *Quiscalus quiscula æneus* Ridgw.
59. Rusty Blackbird *Euphagus carolinus* (Müll.)
60. Baltimore Oriole *Icterus galbula* (Linn.)
61. Red-winged Blackbird
bird *Agelaius phæniceus phæniceus* (Linn.)
62. Cowbird *Molothrus ater ater* (Bodd.)
63. Crow *Corvus brachyrhynchos brachyrhynchos*
Brehm

64. Northern Raven *Corvus corax principalis* Ridgw.
65. Canada Jay *Perisoreus canadensis canadensis*
(Linn.)
66. Blue Jay *Cyanocitta cristata cristata* (Linn.)
67. Prairie Horned Lark. *Otocoris alpestris praticola* Hensh.
68. Least Flycatcher *Empidonax minimus* (W. M. & S. F.
Baird)
69. Alder Flycatcher *Empidonax trailli alnorum* Brewst.
70. Yellow - bellied Fly -
catcher *Empidonax flaviventris* (W. M. & S.
F. Baird)
71. Wood Pewee *Myiochanes virens* (Linn.)
72. Olive - sided Fly -
catcher *Nuttallornis borealis* (Swains.)
73. Phoebe *Sayornis phæbe* (Lath.)
74. Crested Flycatcher .. *Myiarchus crinitus* (Linn.)
75. Kingbird *Tyrannus tyrannus* (Linn.)
76. Ruby-throated Hum-
mingbird *Archilochus colubris* (Linn.)
77. Chimney Swift *Chætura pelagica* (Linn.)
78. Nighthawk *Chordeiles virginianus virginianus*
(Gmel.)
79. Whip-poor-will *Antrostomus vociferus vociferus*
(Wils.)
80. Northern Flicker ... *Colaptes auratus luteus* Bangs
81. Red-headed Wood-
pecker *Melanerpes erythrocephalus* (Linn.)
82. Northern Pileated
Woodpecker *Phlæotomus pileatus abieticola* (Bangs)
83. Yellow-bellied Sap-
sucker *Sphyrapicus varius varius* (Linn.)
84. American Three-toed
Woodpecker *Picoides americanus americanus*
Brehm
85. Arctic Three-toed
Woodpecker *Picoides arcticus* (Swains.)
86. Downy Woodpecker.. *Dryobates pubescens medianus*,
(Swains.)
87. Hairy Woodpecker .. *Dryobates villosus villosus* (Linn.)
88. Belted Kingfisher ... *Ceryle alcyon alcyon* (Linn.)
89. Great Horned Owl.. *Bubo virginianus virginianus* (Gmel.)
90. Bald Eagle *Haliaeetus leucocephalus leucocephalus*
(Linn.)
91. Broad-winged Hawk. *Buteo platypterus* (Vieill.)
92. Marsh Hawk..... *Circus hudsonius* (Linn.)
93. Canada Ruffed
Grouse *Bonasa umbellus togata* (Linn.)
94. Spotted Sandpiper .. *Actitis macularia* (Linn.)
95. Solitary Sandpiper... *Helodromas solitarius solitarius*
(Wils.)

- 96. Great Blue Heron... *Ardea herodias herodias* Linn.
- 97. Wood Duck *Aix sponsa* (Linn.)
- 98. Black Duck *Anas rubripes* Brewst.
- 99. Merganser *Mergus americanus* Cass.
- 100. Herring Gull *Larus argentatus* Pont.
- 101. Loon *Gavia immer* (Brünn.)

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NOTES ON THE RELATION OF BIRDS TO ADIRONDACK FOREST VEGETATION

By DR. CHARLES C. ADAMS, DIRECTOR

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INTRODUCTION

One of the most pleasant aspects of working in the forest is that it is always changing, not only with the season but also from year to year so that it is always interesting. To learn the laws of these changes, and to know how to mould them to man's advantage, are most important parts in the training of a forester.

The forest is a community of living things, dominated by the trees, and with the shrubby and herbaceous plants living in a subordinate relation. The forest ecologically is even more than this, because all forests contain, in addition to vegetation, a large number of animals which make their home there. We may call such a collection of plants and animals living together a forest association or a forest biotic community. In such a community the trees and shrubs influence the animals, as, for example, in the production of food or shelter; and in turn the animals influence the trees and other vegetation by feeding upon them, or by scattering their seeds and thus extending and aiding the reproduction of the forest. Forests and animals thus influence one another in a vast number of ways and the present paper is intended to call attention to some of the more conspicuous methods in which birds influence forest vegetation in the Adirondacks. I have known men who have spent considerable time in the woods, and yet have failed to observe and understand the results of bird activity. On the other hand, to many observant persons familiar with the woods, the notes here recorded will seem commonplace indeed. It is desirable that foresters possess a proper idea of the general importance of birds to the forest, just as a similar appreciation of the influence of forests upon birds is needed by students of birds and by the public in general.

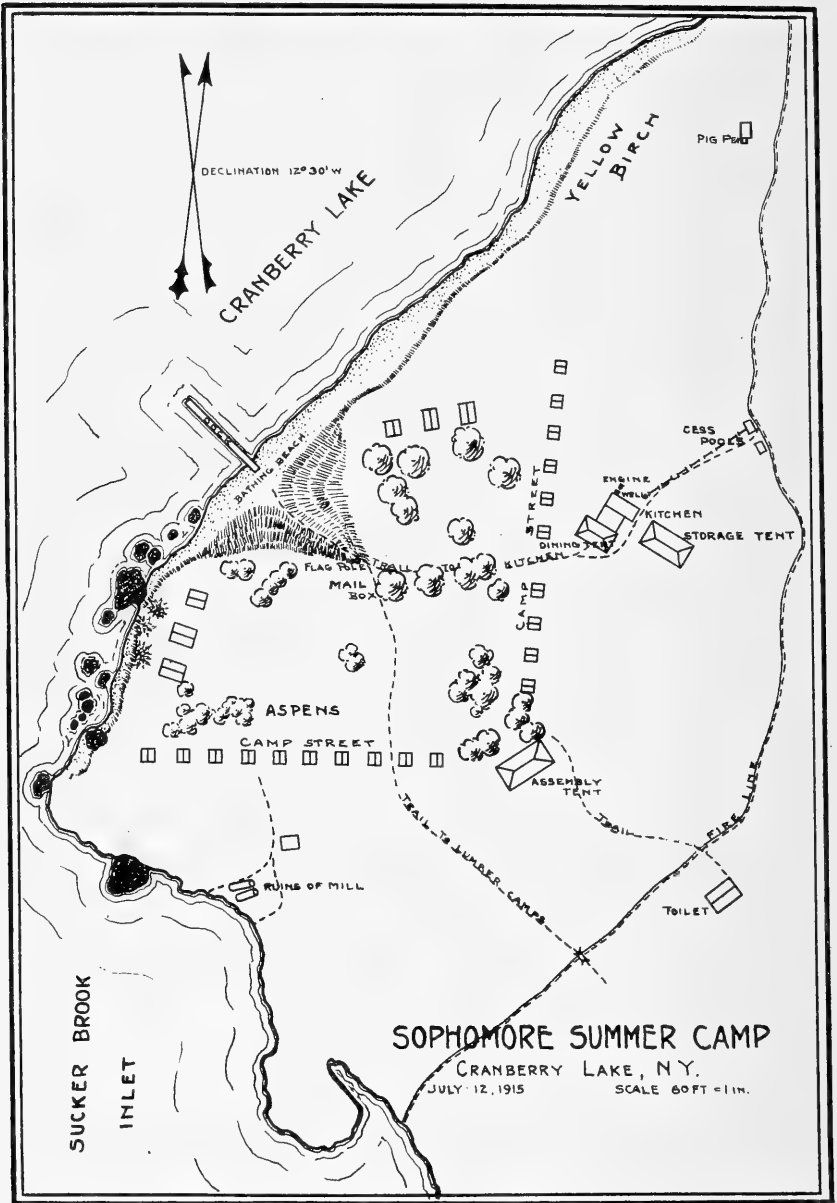


Fig. 142. Sketch map of College of Forestry Summer Camp grounds, at Barber Point, Cranberry Lake, 1915. Adapted from S. N. Riggs.

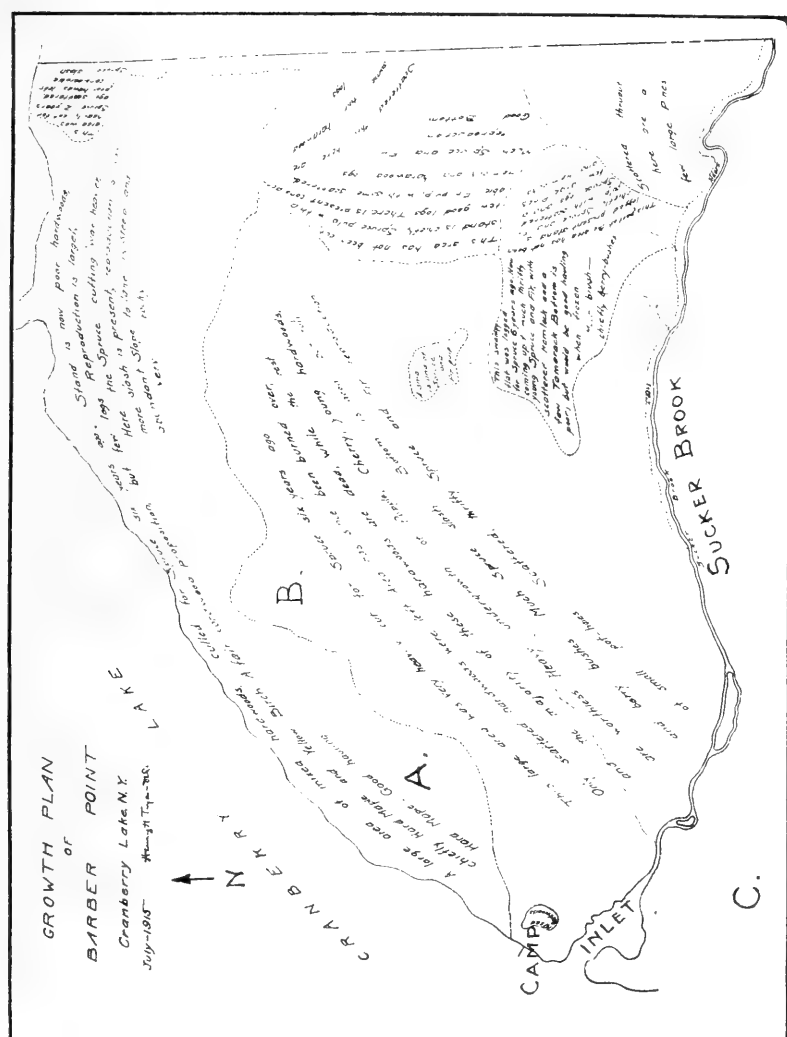


Fig. 143. Sketch map of forest conditions, Barber Point, Cranberry Lake, Wanakena, N. Y. A. Hardwood area. B. Burned area. C. Hardwood forest. Adapted from H. H. Tryon.

GENERAL CHARACTER OF THE REGION

During August of 1915 and again in 1916 I spent several days at the Sophomore Summer Camp of The New York State College of Forestry, at Barber Point, Cranberry Lake, Wanakena, N. Y. This camp is situated on the southeastern side of Cranberry Lake, south of East Inlet, and on the north bank at the mouth of Sucker Brook (figures 142 and 143). The region about the Camp was lumbered in 1909 and 1910 and was largely burned over in 1911. The unburned cut-over forest is composed largely of hardwoods, crippled trees, gnarled, fungus infested, and decayed trunks left when the red spruce (*Picea rubra*) and balsam fir (*Abies balsamea*) were cut. The virgin forest consisted of the hardwoods, hard maple (*Acer saccharum*), yellow birch (*Betula lutea*) and beech (*Fagus americana*), with scattered canoe birch (*Betula alba papyrifera*), quaking aspen (*Populus tremuloides*), large-toothed aspen (*Populus grandidentata*) and bird or fire cherry (*Prunus pennsylvanica*). Mixed with these hardwoods were the hemlock (*Tsuga canadensis*) and red spruce (*Picea rubra*), balsam fir (*Abies balsamea*) and white pine (*Pinus strobus*).

An unburned area, lumbered for spruce (figures 143-A and 144) lay to the north and east of the Camp, as a broad strip along the lakeshore, where it appears to have been protected from fire by a ridge bounding it on the south and east. To the east and northeast of Camp lay the large burned area with its dead and largely branchless stubs, with an undergrowth of bird cherry, red raspberries (*Rubus idaeus*) and other plants (figures 143-B and 145). Many of the cherry trees were not in fruit but others bore in abundance. The raspberries were loaded with fruit. Immediately south of Sucker Brook was also a lumbered area (figure 143-C), now largely hardwoods, with much undergrowth (figure 146), which was formerly logged for spruce. Alder (*Alnus*) and willows (*Salix*) bordered the brook.

Most of the area was of low topographic relief, although the rock ridge, which extended to the northeast of Camp, reached an elevation of about 330 feet as was shown by the surveying students working with Mr. H. H. Tryon. East of Camp, about three miles, was a beautiful virgin forest composed of yellow birch, hemlock, red spruce, white pine and scattered balsam fir (figure 147).

INFLUENCE OF BIRDS UPON THE VEGETATION

In the time at my disposal, not much attention was devoted to determining the kinds or species of birds present in the region, because I was chiefly interested in seeking for evidence which would show the influence of birds in general on the forest. At Cranberry Lake were two phases of bird activity to which I gave attention because of their intimate relation to forestry. I refer to the scattering or dispersal of vegetation by birds (and small mammals) in the burned areas, and to the injury to trees by the Yellow-bellied Sapsucker (*Sphyrapicus varius varius*). The relation of birds to



Fig. 144. Cut-over hardwood forest north of Camp (Fig. 143, A). Undergrowth largely bird cherry planted by birds. Photo 1915.



Fig. 145. Burned area east of Camp (Fig. 143, B); showing bird cherry, berry bushes and fireweed. Photo 1915.



Fig. 146. Cut-over forest of hardwoods, south of Sucker Brook, 1916. (Fig. 143, C); showing extensive undergrowth of berry bushes.



Fig. 147. Virgin forest at Curtis Pond, northeast of Forestry Camp; chiefly of hemlock and spruce. Photo 1915.

injurious forest insects, one of the most important relations of birds to forests, was not considered in the limited time available for field study.*

Reforestation by Birds. That birds eat many kinds of wild fruits is well known to observers of their feeding habits. For example, 39 species of birds are recorded (McAtee '10, p. 186) to feed upon wild cherries (*Prunus*), while raspberries and blackberries are known to be eaten by 60 species of birds. In general the kinds of bird-planted fruits are those that possess three characteristics: an attractive pulp or nourishing fruit; sufficiently small size to be readily swallowed; and seeds which in some manner are able to resist digestion while in the body of the animal—otherwise, of course, the seed would be destroyed, and could not be dropped on some favorable site. Their preservation is usually accomplished by a non-digestible covering that surrounds the germ. Some seeds are also scattered by regurgitation.

The presence in the region of the Cedar-bird (*Bombycilla cedrorum*), Robin (*Planesticus migratorius migratorius*), Catbird (*Dumetella carolinensis*), Ruffed Grouse (*Bonasa umbellus togata*), and many other birds known to eat fruits is a sufficient guarantee, if any were necessary, that birds are available agencies for scattering seeds.

Small red cherries were very abundant locally along Sucker Brook, where great numbers of Cedar-birds were seen perched upon the burned stubs. Never have I seen a greater abundance of wild red raspberry fruit than abounded in the burned and other open places. The amount of this food was far in excess of that which the birds and other animals of the vicinity were able to utilize, and as a result it decayed by the bushel. The stomach of one Cedar-bird was found to contain four cherry stones. On one field-trip Mr. W. E. Sanderson found a Robin's nest with two young beside a stump on the bank of a very small stream, near where the stream from Curtis Pond crosses the logging road to Sucker Brook. When the nest was visited again six days later (August 24), during which interval there had been a severe downpour, the young birds were found dead in the nest. (The dead birds were determined by Mr. W. DeW. Miller, of the American Museum of Natural History). In and about this nest I counted 145 cherry stones which could be counted without destroying the nest, and some stones were left in the field when the nest was collected. Such an accumulation of stones about the nest shows clearly the importance of this fruit in the diet of the Robin. With high water these cherry stones would be transported to other localities and scattered.

Five caged fledged nestlings of the Cedar-bird were fed by Bolles ('90, p. 290) 8,400 cherries in 12 days. He says: "On the average the old bird or birds made 140 visits a day, bringing five cherries each time. One was carried in the beak, and the others were jerked up from the throat one by one until all of the five young were fed."

* Those interested in this phase should consult Sterling ('02) and especially McAtee ('15).

Herrick ('02, p. 61) also gives a very interesting account of food of the young birds as follows:

"The young at this nest were visited and fed 47 times during an interval of exactly ten hours and forty-seven minutes, on three different days. On the last day they were fed on the average once in ten minutes. The food consisted of choke cherries and red bird cherries, varied with raspberries, blackberries, and blueberries, together with insects, which, during the last days of life at the nest, constituted about one quarter of the fare. At one half the number of visits recorded fruit alone was served. From six to ten cherries were brought in the gullet at a time, and once by count eleven blueberries. Feeding was effected almost always by regurgitation in whole or part, and rarely was any food visible when the birds came to the nest. Now and then, however, a bird would approach loaded to the muzzle with a berry or insect in the bill to round out the measure. Soft fruits like raspberries were crushed to a pulp, and insects which are commonly served with berries came up covered with saliva, and often in an unrecognizable state. The staple animal food was grasshoppers and I have seen the large cicada or harvest fly brought to the nest, but never dragon-flies, butterflies, or moths. The cicada made a lively struggle for a few minutes; it was placed in one open throat after another and withdrawn eight different times, before a gullet was found capable of the proper reaction time. If a bird was slow he lost his chance, and another was tried. The key was at last fitted to the lock, and the bruised and battered cicada was taken in, but the old bird had not finished her task. She began tossing up her head and producing bird cherries. Then she gave the nest a thorough renovation. In doing this the mother often walks around the rim, and attends to each nestling in succession, sometimes even inspecting one bird more than once."

Considering the abundance of Cedar-birds, the abundant fruit of the cherry, and the great number of young trees in the burned and cut-over areas (figure 145), it is very evident that this bird is one of the most important tree planters in the burned lands of the Adirondacks. Of course we must not overlook the fact, in fairness to other birds, that many other species have much the same influence in scattering seeds. It is also only fair to state that it is well established that *all* the seeds scattered by birds are not of advantage to the forest. For example, the seeds of many vines are scattered by birds, such as wild grape, five-leaved ivy and poison ivy. Such vines, when they thrive luxuriantly and reach the crowns of trees are able to shut off the light and thereby injure or kill the tree. I have observed many such instances where this kind of harm has been done. During the heavy snow in the upper Hudson Valley in December, 1915, many trees were seen bent down by the weight of the snow that accumulated on the screen of vines. In the Adirondacks, where the snowfall is very heavy, I would suppose that such injury would be of frequent occurrence.

We may not look upon bird or fire cherry with much favor as a forest tree, but such a tree and raspberry bushes produce a vegeta-

tional cover, under whose shade more valuable trees do grow, and further, such vegetation will retard erosion of the soil and its runoff much better than a sparse vegetation. That the growth of cherry, aspens, etc., is favorable to the reproduction of more valuable trees is well known, and is expressed by Frothingham ('11, p. 24), who says: "Just as fire cherry and other small or short-lived trees and shrubs form 'temporary' stands over aspen, so the aspen, in most of its extensive stands, is itself merely temporary, and gives place, within a single generation, to relatively permanent stands of more shade-enduring and longer-lived species, from which aspen is permanently excluded." He names among the more important eastern seedlings which grow up in these temporary stands the red and white spruce, beech, maple, balsam fir and white pine. (For the relation of aspens to reforestation in the Southwest see Pearson '14). From the standpoint also of the hunter such a cover is a vast improvement on bare burned-over land. The relation of birds to game, although the influence of the birds is not definitely mentioned, is clearly shown by the fact, as Gaylord has shown, that in the Adirondacks deer thrive best in open woods, such as may be formed by lumbering, or in burns after vegetation has again become established. He says ('15, p. 29): "Out of the 50,000 acres immediately under my supervision there are 14,000 burned over, and it is here * * * that they [deer] are the most plentiful and in the best condition — why?— simply because the food supply is the best and the most abundant, due to the numerous vines, grasses, and bushes that grow in such places."

We must therefore look upon the scattering of seeds by birds and other wild animals as a method of *reforestation* done without charge. This is a very valuable service, which supplements the wind-blown seeds of the aspens and birches. This scattering of tree seeds by birds must therefore be considered as particularly important in wild lands, and the value of this will last until man is alert and progressive enough to do the work better and more intelligently or by hiring men to do it. There are thus excellent reasons why fruit-eating birds should never be needlessly injured in wild lands by foresters and hunters, especially where there is imperfect fire protection, and where game is valued. The destruction of the forest cover is harmful to the flow of streams, and directly to fish; conversely, reforestation is likewise beneficial to fish. In other words, the birds benefit the fish as well as the game. Even at the present rate of progress it will be a long time before the services of such birds can be looked upon as superfluous or harmful, and all they have done up to the present time stands to their credit. It would be very interesting to estimate how much benefit of this kind in dollars has been done by the birds of New York State, for the forests, the hunter and the fisherman. Certainly the people of New York have received many thousands of dollars in benefit from this kind of work by birds.

We are now in a position to see how it is that birds have so much influence in changing the conditions in forests, because we

can see that after a fire birds and the wind re-seed the soil and greatly hasten reproduction. When once the soil is seeded the maturing of the trees in itself gradually changes conditions until a mature forest is developed. But planting and reproduction are not limited to burned areas alone, for the same process is in operation at all times in the forest, at the forest margin and in the open, and thus many trees are planted.

The amount of benefit done by the birds in forests is not uniform, but varies greatly with the conditions. In burned areas plantings are perhaps of greatest value, but after reproduction has been thoroughly established the destruction of potentially harmful insects is probably of greater value. Generally this early vegetation in burns is short lived and is replaced by other kinds of trees in the mature forest, although scattered choke cherry (*Prunus virginiana*) trees may survive even among sugar maple, hemlock and beech. By recalling such facts we are able to see the relative influence or rôle of birds in hastening the cycle of changes from a burn to a mature forest, and to see how they aid in this change, while at the same time they cause no harm of first importance.

Influence of Sapsuckers on Forest Trees. As we have seen that the rôle of birds in scattering seeds on burned areas is a beneficial one, I wish now to consider a somewhat contrary influence—the direct injury to trees by a bird, the Yellow-bellied Sapsucker (*Sphyrapicus varius varius*). In discussing the character of this injury I mean to consider the trees in the order in which they develop after a fire. This is the sequence or succession of reforestation, and this order is followed because of its importance, and because of the value of a familiarity with this particular sequence. For this reason aspen and birch will be considered first, and later beech, hemlock and other trees that characterize a mature forest.

South of Camp, about three-quarters of a mile, is a cove or small bay along the shore of which a fire has burned. An extensive strip of aspens has grown up near the water and in this clump of trembling aspens (*P. tremuloides*) was found much evidence of injury by Sapsuckers (figure 148). Attention was first called to the injury by a mass of dead leaves remaining on a tree. These dead trees were found girdled in the manner characteristic of Sapsuckers. They had evidently been killed during the season of 1915, or the leaves would not have remained on. Other trees were found with the leaves turning yellow, in the act of dying. It was at once seen that the extent of the injury was somewhat unusual, so that a careful search was then made throughout these aspens for other evidences of injury. In all thirty trees were discovered that showed distinct evidences of Sapsucker work. Every stage was found from living injured trees, which had healed their wounds and had recovered completely, to dying, recently dead, and on to dead ones of perhaps a few years standing, with fungi growing on the dead wood (a reddish fungus *Tubercularia pezizoidea* S., and *Valsa*; determined by Dr. L. H. Pennington); and one dead and decayed tree that had been broken by the wind (No. 1). The



Fig. 148. Colony of quaking aspen, south of Camp on shore of lake (shown in distance) where young trees were much injured by Sapsuckers. Photo 1916.



Fig. 149. Sapsucker injury to young aspens.

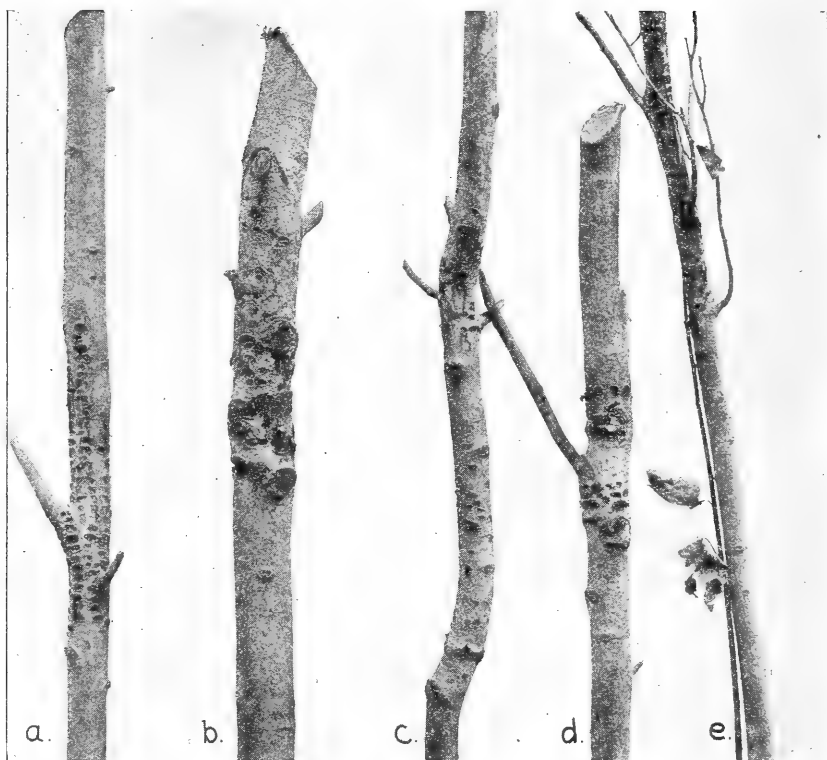


Fig. 150. Sapsucker injury to young aspens.



Fig. 151. Colony of aspens and birches at Forestry Camp. The aspens were much injured by Sapsuckers. Photo 1916.

injured specimens ranged in diameter from about $\frac{3}{4}$ of an inch to $1\frac{1}{2}$ inches, and each specimen secured represented a single tree and not branches or parts of trees.

One dead tree (No. X) was an excellent example of severe girdling. This tree was 1.25 inches in diameter and very severe girdling extended over 27.5 inches of the stem (figure 149a). The holes were so numerous that long vertical strips of the bark had been removed, or had curled and fallen off as the bark dried out. It was one of the most extensive and thorough injuries observed on an aspen. This tree was probably killed early in the season of 1915. Complete girdling (No. 5), largely concentrated in a seven-inch belt, is well shown in figure 149b, and a similar (No. 12) but even more severe attack is shown in figure 150c.

A dead tree was found which had been girdled in a narrower belt, of about 8 inches in length. In some cases there had been considerable healing (No. 10) and the stem had a knotted or gnarled appearance (figure 150d). In the case of some specimens (No. X, figure 149a, and No. 12, figure 150c), the injury was so extensive that death was rather sudden, for the burrows were fresh and clean cut in appearance, as if no progress had been made toward healing at the time of death. One small tree, $\frac{7}{8}$ inch in diameter (No. 4), showed injury of similar freshness, for the dead leaves were still on, except a very few, which were still green in part (figure 150e). The wounds on this extended over about 14 inches of the stem, and were unusual in that they were very irregular in position, both horizontally and vertically.

Another series of trees had been girdled in varying degrees (Nos. 2, 8, 9, 9a, 9b, 9c, 13, 14, 15, 16 and 17) but were alive. A tree about an inch in diameter (No. 9a) had been severely wounded in patches, for 35 inches along the stem. The gnarled areas are shown in figure 149c. Some of the old wounds are peculiar in that they give the bark the appearance of an irregular flattened or sunken blister, with the central perforation and an elevated rim. These show that irregular areas of about half an inch by three-quarters were killed by the perforation; six of these blisters were found on this stem. Nos. 8 and 9 each showed one of these blisters, and No. 9b showed many of such patches. One (No. 9b) had been severely girdled several years ago and gnarled wounds had developed; it seems to have suffered two or more later attacks, one in the vicinity of the old wound and others near the base of the tree (figure 149d). The main later attack completely encircled the trunk and yet the tree had apparently recovered, or at least looked healthy.

Two live trees had been injured recently (Nos. 13 and 15) so that they might not have revived, as the girdling was very complete and concentrated. One (No. 15) showed the blister effect, another (No. 14) had been severely girdled (figure 150d); considerable progress had been made in healing, as it also had on a less injured one (No. 16). One tree (No. 17) was found dying,

the leaves curled, but not turning yellow, as they sometimes do. This tree had been completely girdled over an area of six inches of the trunk. This injury had reinforced an older one of the same kind that extended around nearly half of the stem. Although the girdling of the tree (No. 2) was very severe, healing had made considerable progress and the leaves were yet green when the tree was cut.

In August, 1916, I again visited this same clump of aspens (figure 148), went over the area in more detail than on the previous year, and found two dead trees (one with brown leaves on), 22 injured (9 severely), and four cases doubtful as to cause of scars. To my surprise no fresh injuries were observed in this place. One tree two inches in diameter was irregularly but completely girdled five feet from the ground, over a six-inch zone, yet looked in good condition.

I wish to refer to only one other kind of influence of the birds in this colony of aspens and that is to the growth of lateral buds or suckers that develop below the girdling of the stem after the upper part dies. I found several good examples of this (Nos. 7, 18, 19, 20, 21 and 22) in 1915, and one (No. 21) in 1916. A small tree, hardly larger than a lead-pencil, had been severely girdled for about ten inches of its stem, and large rectangular patches of the bark had been removed rather recently. Below this injury a big sucker developed, bearing much larger leaves than corresponding ones on the normal tree (figure 150e). Two good examples of these suckers are shown in figures 149e and f. I examined a large colony of aspens in search of larger trees whose tops had been killed but whose suckers had developed and had thus formed a new stem. I found two with bent stems, but no evidence remained to indicate that the stem had been killed by Sapsuckers.

One tree (No. 21) with dead and dry brown leaves on it, had been severely girdled, and some of the bark and wood above the injury was yet green. This tree was $1\frac{1}{4}$ inches in diameter 4 feet above the soil, and the injury began at 34 inches above the ground, but the girdling proper at 37.5 inches, and extended along the trunk for 10 inches. A large sucker grew out at 15.5 inches above the ground, grew for about a foot and then had died at the top.

Many of the small aspens about the Camp showed a few holes made by Sapsuckers in 1915, but in August, 1916, a clump of small trees at the south part of the Camp were the scene of considerable Sapsucker activity (figures 151 and 152.) Four trees were specially noted. Tree No. 1, which was 2.5 inches in diameter 4 feet from the ground, was injured 7 feet from the ground, and the injured zone extended along the trunk for about 2 feet. No. 2 was 3.5 inches in diameter 4 feet above the ground, the injury began at 6 feet above the ground and extended upward about 30 inches, but was mainly concentrated in the first foot. The lower 4 inches, the older injury, was constricted and dried out, while the upper 8 inches was somewhat enlarged and was

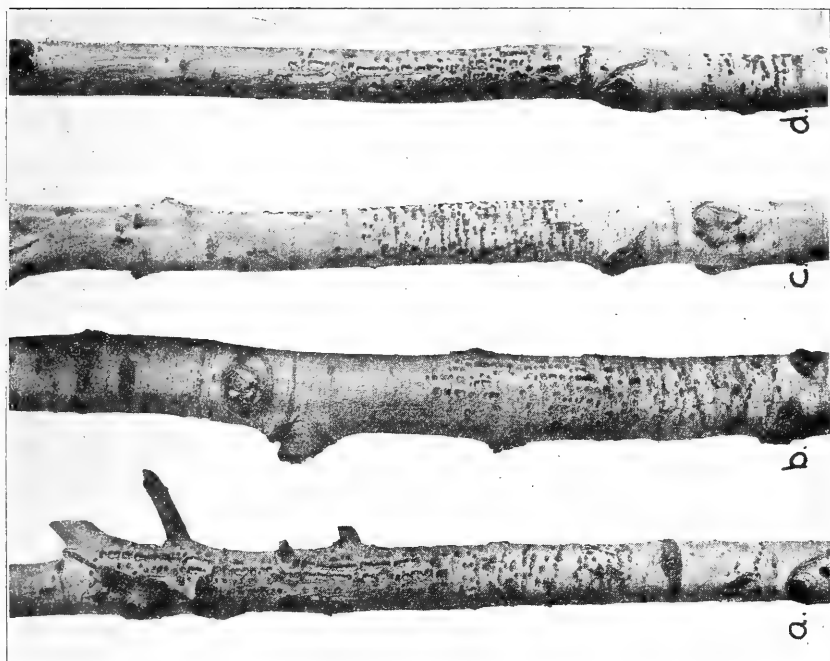


Fig. 153. Detailed view of aspen trunks injured by Sapsuckers.

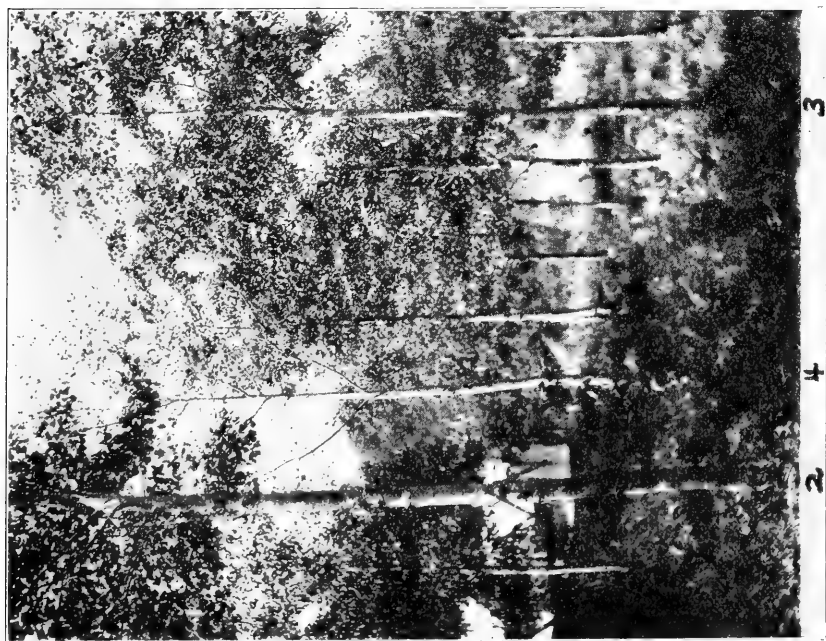


Fig. 152. Nearly view of the aspen clump shown in Fig. 151. Photo 1916.

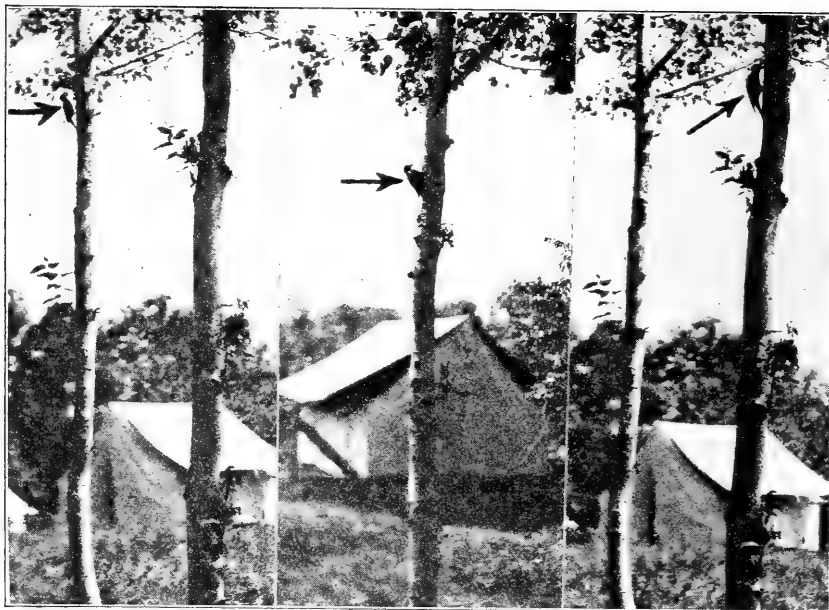


Fig. 154. Sapsuckers working on aspens. Photo 1916.



Fig. 155. Injury to large-toothed aspen by Sapsucker, at Forestry Camp.

fresh, recent work. This girdling was very thorough and it is remarkable that the tree was not dead. No. 3 was dead with dry leaves attached. It was 2.5 inches in diameter 4 feet above the ground. The girdling began over 5 feet above the soil and extended upwards about 3 feet, but was mainly concentrated. No. 4 was dying, as its leaves had begun to turn slightly yellow. It was 2.2 inches in diameter 4 feet above the ground; girdling (old) began at 4 feet 8 inches, the fresh work began at about 5 feet, 6 inches, and extended up the trunk about 20 inches, and above the concentrated old injury there was an enlargement of the trunk. This detailed character of the injury on each of the tree trunks is shown in figure 153. The older injury was in general lower down on the trunk than the newer. The birds working on these trees were very tame (figure 154), and pounded away within 10 to 15 feet of me, so that the light-colored chips could easily be seen falling as their work progressed. Occasionally they were seen to act as if picking insects from the trunk, and one was observed to leave the tree, and flycatcher-like, attempt catching insects on wing. One very warm day the birds were observed to hold their mouths open as if panting, as poultry sometimes do when overheated. The amount of bark and wood removed at my visit to the trees seemed slight, and it was only by watching the work from day to day that the progressive extension of the injured area became clearly evident.

At the Camp a large-toothed aspen (*Populus grandidentata*) overhung the lakeshore, on which there were numerous sapsucker holes in 1915. The general character of the injury is well shown in figure 155, where a two-foot rule serves as a scale in the illustration. This was the only example of this tree found showing injury. In August, 1916, additional freshly bored scattered holes were noted on this tree.

Near the colony of aspens, which were injured so much (figure 148), were two excellent examples of sapsucker injury to large trees of yellow birch (*Betula lutea*). They stood near the lakeshore in an open burned area. The general character of the injury on one tree is well shown in figure 156, which reveals the scattered holes near the base of the tree and up the trunk to near the lower branches. The concentration of the injury here into vertical rows is characteristic. On such large trees the bark is very thick so that the cavities produced are about a third of an inch deep, and were deeper when the tree was alive. The healthy look of the tree shown in the figure indicates that it had not been injured seriously. A near view of this injury is shown in figure 157. On the other hand, another tree of the same kind near by had been killed by the repeated attacks (figure 158). Some parts of the trunk are weathered and darker stained than other parts, which may be due to a difference in age or to the flow of rain-water down the trunk. A careful examination of the trunk shows no evidence of healing, a fact that suggests a concentrated attack and rather early death. A more detailed view of the trunk is shown in figure 159.



Fig. 156. A yellow birch south of the Camp, injured by Sapsuckers. Photo 1915.

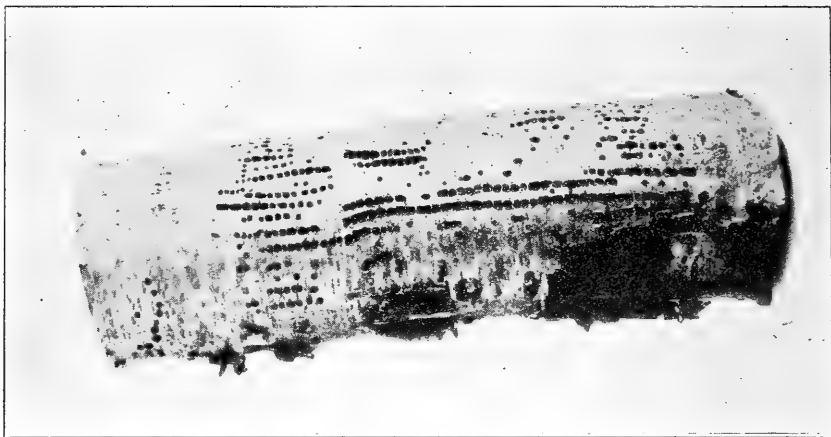


Fig. 157. Detailed view of part of yellow birch trunk shown in Fig. 156

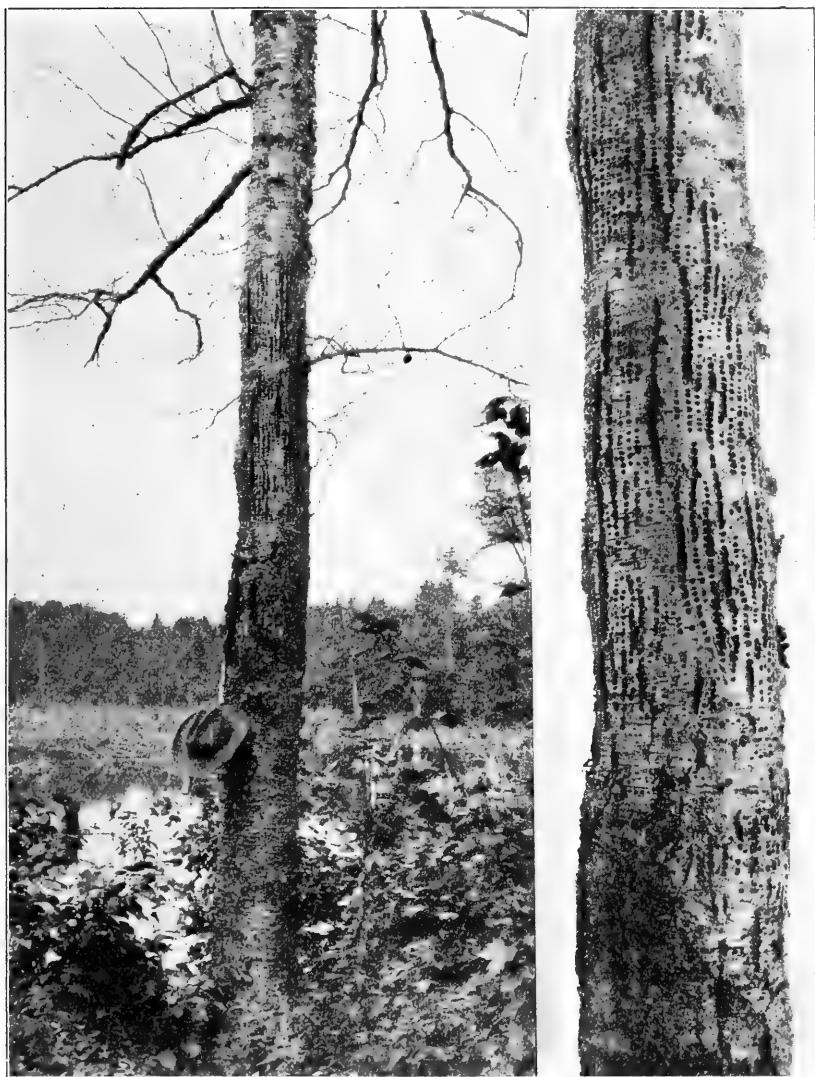


Fig. 158. Large yellow birch south of Forestry Camp. This tree had been killed by Sapsuckers. Photo 1915.

Fig. 159. Section of trunk of yellow birch shown in Fig. 158.

A very interesting example of injury to paper birch (*Betula alba papyrifera*) was found at Camp, behind my tent (1915), on a tree overhanging the lakeshore, and near the large-toothed aspen previously mentioned. This birch had been repeatedly attacked, so that a distinct swelling had been caused in the trunk, as is shown in figures 160 and 161 (cf. McAtee, '11, p. 19). This was the only example of such a marked deformity. At five feet above the ground this tree is 8.5 inches in diameter. The swelled girdled area is within 3.5 feet of the ground, and extends over about one foot of the trunk. At eight feet above the ground is another extensive area, also of about one foot, but only slightly enlarged; at about 12 feet there is an area of about 6 inches in height, and scattered punctures are found on the trunk at various levels.

North of the Camp, along the trail near the lakeshore, and in the cut-over forest, was observed injury on a yellow birch. A tree ten inches in diameter was found about half-girdled, but only about half of the distance had more than a single row of holes. Just north of the line of tents at the Camp were numerous yellow birches, six of which showed considerable work of the Sapsucker. One dead tree at the edge of the lake bluff, about 11.5 inches in diameter at five feet above the ground was almost completely girdled from 5.5 inches from the ground upward for about four feet. The holes are large, many rectangular, and some in the long columns characteristic of extensive injury.

A hemlock about 3.2 inches in diameter had a cluster of about 20 punctures, 5.5 feet above the ground, and higher up among the branches was found an almost complete girdle of holes. Some of the vertical rows were rather regular, as shown in figure 162a. The best example, however, of prolonged and thorough drilling in hemlock was found along a trail south of Camp, just beyond Sucker Brook, in the cut-over area. This tree was six inches in diameter and was thoroughly drilled with thousands of holes. The lower part of the trunk is shown in figure 162b, exhibiting large numbers of fresh, scattered holes, and a few well-defined horizontal rows. Probably the majority of the old holes are of the same character. In a few places the bark had been killed in vertical rows; and where the wound had healed a saw-toothed fringe of old punctures in the bark clearly showed the cause of the original injury. The general appearance of these old scars is shown in the figure. (Cf. McAtee, '11, plate 8, figure 4.) When we consider the number of punctures on this tree we can only wonder at the immense number of chances it involves for this bird to carry fungus spores and thus inoculate trees, since it is definitely known that spores are carried by birds. For our American birds this has only recently been established in the case of the chestnut blight (*Endothia parasitica* Murr.), by Heald and Studhalter ('14). This is a fungus, however, which is not likely to be of much importance in the Adirondacks.

Injury to a beech was observed south of Camp, near the badly injured aspens and yellow birches. The tree was near the lake-

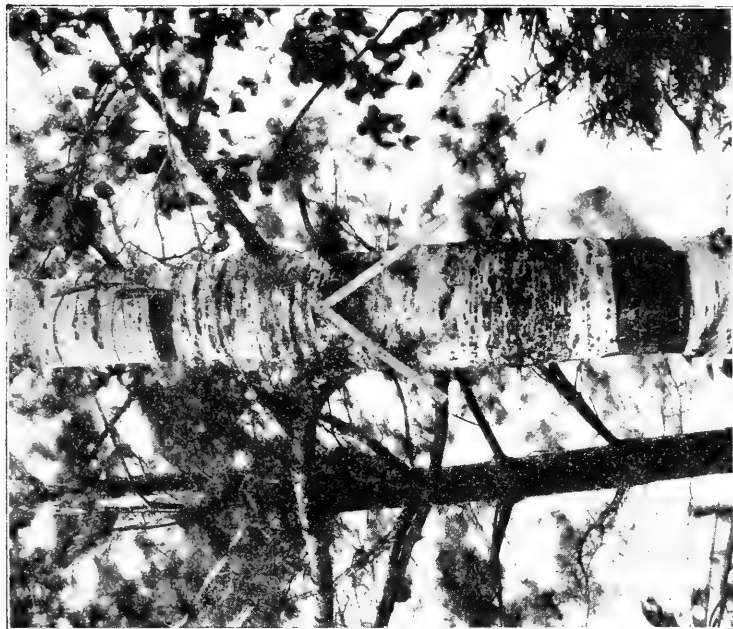


Fig. 161. A section of the paper birch trunk shown in Fig. 160.

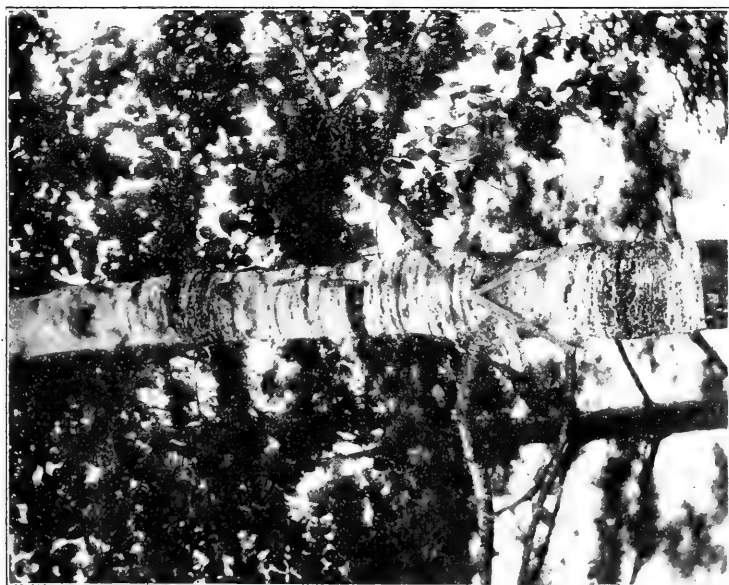


Fig. 160. Paper birch injured by Sapsuckers and showing swelling of trunk.

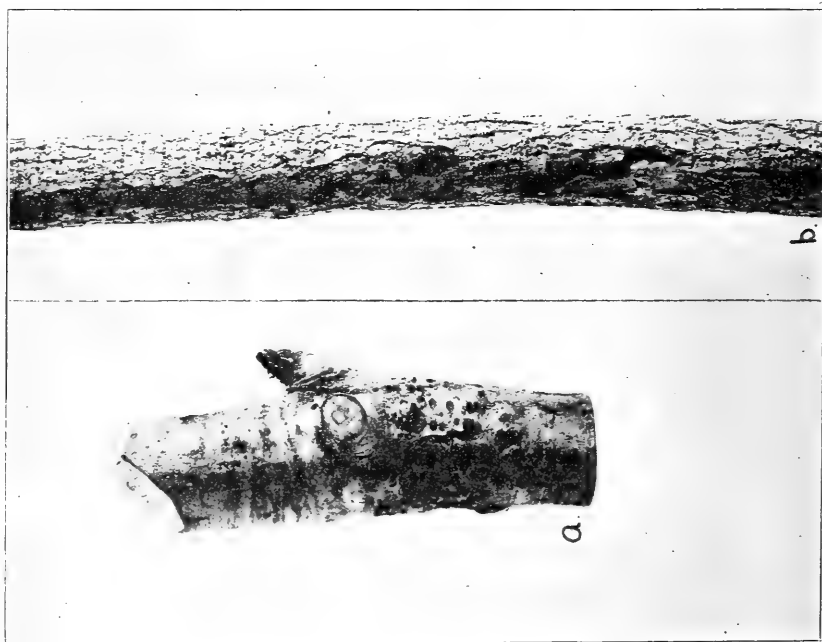


Fig. 162. Hemlock trunks, with numerous borings by Sapsuckers, from hardwood forest near Forestry Camp.



Fig. 163. Beech injured by Sapsuckers, in cut-over forest south of Forestry Camp. Photo 1015.

shore in an open place. Two distinct patches of injury are shown in figure 163, one just above the hat and the other at the upper end of the large scar near the base of the tree. Upon a large tree, felled near the logging camp on Sucker Brook, was found a branch, with the old injured bark showing the characteristic sapsucker-scars, upon which, as the wound healed, it had encroached. A beech log about 7 inches in diameter was found with extensive girdling around about three-quarters of the trunk. The attack had been severe, and large rectangular areas had been bored out in an irregular fashion.

A dead, fungus-infested hard maple was found north of Camp in the cut-over forest—was about half girdled for a vertical distance of nearly six inches. At about six and a half feet above the ground, where the tree had a diameter of three inches, the girdling was complete for a vertical distance of about a foot.

The favorite haunts of these Sapsuckers are of special importance, because they give an idea of the conditions where injury is likely to be the greatest. Bolles ('91; p. 257) states that "their favorite haunts are mixed growths of young birch, larch, hemlock, maple, and white ash bordering water or wet places;" and Eaton ('14, p. 151) remarks: "In the Adirondacks I noticed that they seemed to prefer beeches, birches and maples for nesting sites. The nest is almost always built under the shelter of the forest and not in clearings, as in the case with Red-headed Woodpeckers and Flickers." These limited observations are enough to show that this bird, which is reputed to be the most abundant Woodpecker in the Adirondacks, is exerting considerable influence upon the forests. But to justly estimate this influence it is necessary to include the observations made by others on the activities of this species.

An excellent account of the habits of Adirondack Sapsuckers has been given by Dr. C. Hart Merriam ('79, pp. 3-5) as follows: "In the Adirondack region, during the migrations, they outnumber all the other species of the family together, and throughout the entire summer are second in numbers only to the Hairy Woodpecker (*Picus villosus*). Here they often, in search for insects, strip off the 'shag-bark' from the spruce, and it is no uncommon thing, in passing through these primeval forests, to meet with many large trees thus almost completely denuded of their outer bark for nearly the entire length of the trunk. These trees are very conspicuous objects, and never fail to excite the curiosity of strangers, who are much more willing to believe the existing condition 'due to the ravages of the Black Cock of the Woods (*Hylatomus pileatus*) or Porcupine (*Erethizon dorsatus*)' than to the present innocent-looking species.

"In the central district they really do considerable mischief by drilling holes in the bark of apple, thorn-apple, and mountain-ash trees in such a way as to form girdles of punctures, sometimes two feet or more in breadth (up and down), about the trunks and branches. Whether in like manner they affect trees (excepting occasionally a young elm) pertaining to other genera than the one

(*Pyrus*) to which the above belong, I am unable to say; but the fact of their destroying some of these, notably the apple, and especially in the west, has often been recorded. The holes, which are sometimes merely single punctures, and sometimes squarish spaces (multiple punctures) nearly half an inch across, are placed so near together that, not unfrequently, they cover more of the tree than the remaining bark. Hence, more than half of the bark is sometimes removed from the girdled portions, and the balance often dries up and comes off. Therefore it is not surprising that trees which have been extensively girdled generally die, and mountain ash are much more prone to do so than either apple or thorn apple tree due, very likely, to their more slender stems.

"The motive which induces this species to operate thus upon young and healthy trees, is, I think, but partly understood. It is unquestionably true that they feed, to a certain extent, both upon the inner bark and the fresh sap from these trees, but that the procurement of these two elements of sustenance, gratifying as they doubtless are, is their chief aim in making the punctures I am inclined to dispute. As the sap exudes from the newly made punctures, thousands of flies, 'yellow-jackets,' and other insects congregate about the place, till the hum of their wings suggest a swarm of bees. If, now, the tree be watched, the Woodpecker will soon be seen to return and alight over that part of the girdle which he has most recently punctured. Here he remains, with motionless body, and feasts upon the choicest species from the host of insects within easy reach. Therefore it is my firm belief that their chief object in making these holes is to secure the insects which gather about them.

"Some time ago Mr. C. L. Bagg called my attention to a clump of mountain-ash whose leaves had turned yellow and were fast falling off. Here a pair of these birds, with their young, had established an unfailing food supply, and at almost any time of day several of their dark motionless forms might be seen adhering to the trunks and branches of the young trees. Evidently this had been their headquarters for several seasons, for all the main stems in the cluster were girdled for at least five feet (commencing two or three feet from the ground), and most of the branches of any size were likewise punctured. In making each girdle they work around the trunk, and from below upwards, but they may begin a new girdle below an old one. They make but few holes each day, and after completing two or three remain over the spot for some little time, and as the clear fresh sap exudes and trickles down the bark they place their bill against the dependent drop and suck it in with evident relish,—a habit which has doubtless given rise to the more appropriate than elegant term, 'Sap-Sucker,' by which they are commonly known in some parts of the country. I have several times watched this performance at a distance of less than ten feet, and all the details of the process were distinctly seen, the bird looking at me, meanwhile, 'out of the corner of his eye.' When his thirst is satisfied he silently disappears, and as silently returns again, after a few hours,

to feast upon the insects that have been attracted to the spot by the escaping sap. This bird, then, by a few strokes of its bill, is enabled to secure both food (animal and vegetable) and drink in abundance for an entire day; and a single tree, favorably situated, may suffice for a whole season!"

Frank Bolles ('91, '92) also made very interesting observations on the feeding habits of these birds in New Hampshire, as is shown by the following quotations ('91, pp. 257-258): "The tree most recently tapped was a red maple about 40 feet high and 2 feet through at the butt. The drills made by the Woodpeckers began 18 feet above the ground and formed a girdle entirely around the trunk. The girdle contained over 800 punctures and was about 3 feet in height. In places the punctures or drills had run together causing the bark to gape and show dry wood within. The upper holes alone yielded sap." He concludes (p. 270): "that the Yellow-bellied Woodpecker is in the habit for successive years of drilling the canoe birch, red maple, red oak, white ash and probably other trees for the purpose of taking from them the elaborated sap and in some cases parts of the cambium layer; that the birds consume the sap in large quantities for its own sake and not for insect matter which such sap may chance occasionally to contain; that the sap attracts many insects of various species a few of which form a considerable part of the food of this bird, but whose capture does not occupy its time to anything like the extent to which sap drinking occupies it; that different families of these Woodpeckers occupy different 'orchards,' such families consisting of a male, female and from one to four or five young birds; that the 'orchards' consist of several trees usually only a few rods apart and that these trees are regularly and constantly visited from sunrise until long after sunset, not only by the Woodpeckers themselves, but by numerous parasitical Hummingbirds which are sometimes unmolested, but probably quite as often repelled; that the forest trees attacked by them generally die, possibly in the second or third year of use; that the total damage done by them is too insignificant to justify their persecution in well-wooded regions."

McAtee ('11) has made an elaborate study of the influence of this Woodpecker on trees and wood, and records (p. 53) that: "Twenty-nine of these trees and one vine are known to be sometimes killed and twenty-eight others are much disfigured or seriously reduced in vitality."

The kind of food and drink utilized has been given considerable attention by Beal ('95, '11). Sap, bast and cambium are the main food elements. An examination of the stomach contents of more than 300 birds by Beal ('11) shows that the food is about half-and-half animal and vegetable. The vegetable food consists largely of wild fruit and cambium. In April cambium may amount to nearly half the bulk of the food. It eats a large amount of wild fruit, and thus is an important agent in the scattering of tree and shrub seeds. The tree seeds eaten are those of red cedar, hackberry, sassafras, choke cherry, black cherry and sour gum. Sev-

eral of these are trees mainly southern in range, and do not grow in the northern breeding area. Beal (l. c., p. 30) says "Poison-ivy seed was contained in seven stomachs and poison sumac in one, so the Sapsucker does little harm by distributing the seed of these noxious plants." Ants form the largest part, or 69 per cent, of the animal food, and about one-third of all the food; the remainder of the animal food consists of insects. Bolles ('92) experimented with young birds, feeding them on maple-sugar syrup to see if they could live solely on such a diet. Although these birds secured some insect food they lived about four months and died with diseased livers, showing that syrup was not a normal diet.

To evaluate the ant food of the Sapsucker it is desirable to consider the role of ants in the forest, as expressed by Wheeler ('10, p. 8), who says: "Eminent economic entomologists, like Taschenberg and Ratzeburg, who have studied the ants in the German forest preserves, are of the opinion that they are highly beneficial. A German law, passed in 1880, punishes with a fine of 100 marks or a month's imprisonment any person who collects the cocoons of the fallow ant, *Formica rufa*, or wantonly disturbs its nests in the forest preserves. * * * The greatest usefulness of ants, which lies in their power to hasten the decomposition of organic substances, is easily overlooked or belittled, like all the great forces which act very gradually but incessantly. * * * (p. 9): The activities of ants in excavating their nests have a very useful aspect. Most of the species, especially in temperate latitudes, nest in the ground, and many of them in so doing are obliged to comminute and bring to the surface, often from a depth of several feet, considerable quantities of subsoil. This is spread over the surface either by the elements or by the ants themselves and exposed to the sun and atmosphere. The burrows, moreover, quickly conduct air and moisture into the deeper recesses of the soil. Thus the ants act on the soil like the earthworms, and this action is by no means inconsiderable, although as yet no one has studied it in detail." The conversion of plant remains, leaves and wood into humus and soil serves in addition to its enrichment as an important protective factor in the forest, by rapidly converting this highly inflammable material into a less inflammable state, and thus aiding in fire protection. Of course, there are many animals, besides ants, which have this influence on the forest.

In August, 1916, an effort was made to learn something of the relation of Sapsuckers to the ants which were commonly observed crawling on the trunks of the trees frequented by these birds. The materials were later sent to Dr. W. M. Wheeler, Harvard University, who kindly made the determinations. On an aspen sucker attending plant lice was found (No. 11) *Formica fusca*, and crawling on the trunks were (No. 27) *Camponotus herculeanus ligniperda noveboracensis* and *Formica fusca*.

On August 21, I observed a Sapsucker crawling about over a large white pine, apparently picking up insects occasionally from the bark. When it flew away I found on the bark near where the

Sapsucker had been feeding several large black ants (No. 18), which proved to be *Formica fusca*. At the same time fresh moist excrement was found on a twig adjacent to where the Sapsucker had been seen to void. On examining this with a hand lens I saw it was composed mainly of the chitinous fragments of ants, which proved to be *Formica fusca*. I then revisited the aspens which had been resorted to so regularly and searched about the base of the trees for further evidence from the excrement. Several samples were taken, some (Nos. 20, 23, 28, and 30) contained *Camponotus herculeanus pennsylvanicus*, and another (No. 29) contained *Formica fusca* and *Lasius niger americanus*. I think this direct and indirect information is harmonious and clearly indicates that ants are an important element in the diet of the Sapsucker at this season of the year. Beal ('11, p. 29) says concerning the food of this bird: "Ants amount to 34.31 per cent of the whole food, or 69 per cent of the animal part. They are evidently favorite food, being eaten quite regularly through the year, although the months from May to August, inclusive, show the highest percentages, averaging over 68 per cent." (Cf. also Bequaert '22, p. 307).

All of the species of ants mentioned above, *Formica fusca* (Linn.); *Camponotus pennsylvanicus* (De G.), *Camponotus ligniperda noveboracensis* (Fitch), and *Lasius niger americanus* (Emery), are known to make nests in rotten wood. The only species known to do serious harm in forests is *Camponotus pennsylvanicus*, the common carpenter ant, which tunnels in solid as well as rotten wood. These ants become pests about buildings and are also recorded injuring telephone poles in woodlands. All of these species tend to convert woody tissue into humus, and thus have a general beneficial influence in forests. Recently Hawley and Record ('16) have expressed their suspicions of injury to young white pine about ant nests by *Formica exsectoides* Forel (authority for the determination of the species not given). (Cf. Haasis '17). Very recently Pierson ('22) has made a very careful study of this ant, confirming the damage done to trees and suggesting methods for its control. In one case *Formica fusca* (Linn.) was apparently involved. It is very evident that until ants are studied in greater detail, under diverse conditions, we are not in a position to estimate safely their ecologic and economic rôle in forests. Any such investigation should give special attention to the conversion by ants of wood into humus as a method of reducing the fire hazard.

FERMENTED SAP AND SAPSUCKERS

The sap drinking habit of Sapsuckers has led to some interesting comments as to the intoxicating influence of fermented sap on these birds. Thus Bendire ('95, p. 85) states: "That it should be fond of the sweet sap of trees does not surprise me, as this contains considerable nourishment, and likewise attracts a good many insects, which the birds eat, but it is not so easy to account for its especial predilections for the sap of mountain ash, which

has a decidedly bitter taste, and I believe possesses intoxicating properties, unless it be taken for the latter purpose; and the fact that after drinking freely of the sap of this tree it may often be seen clinging to the trunk for hours at a time, as if stupefied, seems to confirm this view." And, similarly, Eaton ('14, pp. 150-151) remarks: "One frequently finds mountain ash trees, pines, black spruces, ironwoods, and birches so weakened by the boring of this species that they never recover from his attack. * * *

As the spring advances and the weather becomes warm, the sap begins to ferment. I suspect this is the reason that the Sapsucker is so frequently found stupefied by feeding on too great an abundance of the liquid. On several occasions I have seen a Sapsucker so gorged with fermented sap that he allowed himself to be picked up in the hand and I have seen one alight on the clothing of a bird-student and climb up his outstretched arm without seeming to realize that he was on a man instead of a tree. It is evident they become tipsy on the sap in the same manner that thrushes frequently become stupefied by feeding upon fermented fruit."

The following observations by Prof. A. G. Whitney, of The New York State College of Forestry, are of interest. He informs me that he saw Sapsuckers at work on gray birches (*Betula populifolia*) at Hanover, N. H., and states that: "The trees were bled steadily and thoroughly and during the daytime the birds drank all the flow of sap; but at night much of it flowed down over the trunk where it fermented during the heat of the day and was wasted. This fermenting was obvious by the appearance of the sap, and the odor was unmistakable. The Sapsuckers were never observed to drink the fermenting sap but were seen to suck up only the fresh liquid from the upper openings."

This reputation for tipping has led to an interesting and amusing article recently published by Johnson ('16), in which he records the opinions of some bird-students on this subject. Evidently further careful field work and chemical study is needed to clear up this problem. It is significant that Beal, who has devoted several years to the study of the food of woodpeckers, does not attempt to discuss the subject of intoxication. Possibly he discredited it. An effort has been made to learn something of the chemical basis for the formation of alcohol in the fermenting sap. In reply to my inquiry the following opinion was given by Dr. H. A. Edson, Physiologist of the Bureau of Plant Industry, United States Department of Agriculture, who has made extensive investigations of the micro-organisms of maple sap, and who wrote to me, under date of July 3, 1916, as follows: "Indeed I am not aware that we have any exact information regarding this question. I am personally inclined to question whether Sapsuckers become intoxicated as a result of drinking fermenting sap. In my investigations in Vermont, I found alcohol production to be a very minor occurrence in the decomposition of sap. The majority of the micro-organisms which I isolated and studied were not producers of ethyl alcohol. None of the yeasts occurring spontaneously in the regions where I

worked produced ethyl alcohol. It is, of course, true that spontaneous fermentation of maple sap results in the production of sap-beer. However, so far as my observation goes, yeast is always added to partially concentrated sap when it is desired to produce this beverage. Some 30 years of observation in the maple-orchards of Vermont lead me to think it is altogether probable that evaporation removes the small quantities of alcohol that may be formed too rapidly to permit of any appreciable percentage in the rather small quantities of sap which may be found in crevices.

"Analyses of decomposing sap show that the sucrose content is considerably diminished as the decomposition becomes pronounced. Invert sugars increase in quantity and are, of course, further decomposed or consumed by the continued growth of moulds and bacteria. I would not care to hazard a guess as to whether the peculiar behavior of sapsuckers who have partaken of fermented maple sap is the result of the beverage or any of its component parts. Personally, I have never seen the indications of intoxication. There may be something in your suggestion that sapsuckers fed upon sucrose contract a sort of diabetes resulting in their death. Of this, however, I know nothing."

Mr. C. W. Carpenter, also of the Bureau of Plant Industry, U. S. Dept. of Agriculture, who has also made a special study of the fermenting sap of the sugar maple, says, in a letter dated Feb. 28, 1916: "I recall no determination of alcohol produced in maple sap through the action of microorganisms. Although the sucrose is inverted to some extent through the action of microorganisms, and the content of invert sugar ordinarily is increased as the sap spoils, I am not in a position to say how much, if any ethyl alcohol is produced. Theoretically it would not be very much from a 3 per cent sugar solution. Such small amounts as were produced conceivably would evaporate or be continually diluted by the inflowing sap, as there are no places on trees where a large amount of sap could accumulate and remain for any length of time. I have never seen the reference to sapsuckers becoming drunk after imbibing such fermented sap. I believe it more likely that if this happens it is a case of autointoxication and not over indulgence in alcohol."

Dr. A. Hugh Bryan, formerly of the Bureau of Chemistry of the U. S. Department of Agriculture and now Supervising Chemist with Arbuckle Brothers of New York, writes me as follows in a letter dated March 28, 1916: "The sap of the maple tree contains anywhere from 0.5 to 3 per cent of sugars, and during the manufacturing season these sugars are principally sucrose. It might be possible that there is a fermentation on warm days of sap that exudes through the bark with the production of alcohol. It is noted that the sap sours very easily, although I have not seen any references to the production of alcohol, by this souring." Still further information has been received from Dr. C. S. Hudson, Chemist in Charge of the Carbohydrate Laboratory of the Bureau of Chemistry of the U. S. Department of Agriculture, in a letter dated March 31, 1916: "With regard to the formation of alcohol from maple sap,

it may be stated that the average sugar content of the sap is about 3 per cent. Assuming that the theoretical yield of alcohol could be obtained from this, it would amount to $1\frac{1}{2}$ grams alcohol or a solution containing $1\frac{1}{2}$ grams alcohol in 100 cc.

"However, it is not believed that alcohol would be produced from maple sap under ordinary conditions. Very little of the sap that may run down the side of the tree collects in the interstices of the bark, as it dries up rather quickly, and while the sap on the surface of the tree may become slightly 'sour' late in the season, it is thought that it would dry up before alcoholic fermentation could take place. It should be noted that early in the season it is usually too cold for fermentation to take place and late in the season the air is warm enough to dry up the sap very quickly.

"The term 'sour' used above serves to indicate a peculiar condition of the sap that is caused by the growth of micro-organisms and should be differentiated from the alcoholic fermentation that may occur through the decomposition of sucrose, and subsequent change of the invert sugar formed to alcohol, when a quantity of the sap is kept for some time at a warm temperature."

At Syracuse in April, 1917, Sapsuckers were very active on several kinds of trees. On the trunk of an ironwood (*Ostrya virginiana*) a pink slime was found growing on the tree where the sap flowed. This Dr. L. H. Pennington kindly examined and reported to be "Principally *Fusarium* sp., probably *F. Zeae* (West) Sacc.," and "some wild yeast (*Saccharomyces* sp.) and Bacteria." He adds: "My observations lead me to think that this or a similar slime-flux *Fusarium* has a perfect stage belonging to the genus *Nectria*." The plants and animals that live upon exuding sap of trees would make a special problem worthy of detailed investigation as a biochemical and ecological problem.

SUMMARY AND CONCLUSIONS

In concluding this discussion of the Sapsucker it is evident that this is a woodpecker which is capable of exerting considerable influence upon trees and forests. As the most abundant woodpecker in the Adirondacks it deserves careful study and a fair trial before condemnation. It habitually injures or kills a large number of trees, including some of slight and others of much economic value. The destruction of some young aspens and birches only amounts to a slight thinning, and may be beneficial to more valuable young trees growing under them, but the killing and injury to older trees is generally harmful. The large diet of wild fruit makes it capable of materially aiding the reforestation of wild burned lands, and in making conditions on such lands more favorable for deer,—as in the case of other fruit-eating birds. It thus also aids in the conservation of soil and water. That it eats relatively few of the fruits of poisonous plants is also favorable. In a managed forest it would plant "weed" trees, but this is not much of a present-day problem. Of course, other birds do the same kind of work, and for this

reason if the Sapsuckers were reduced in number other species might be substituted. The marked preference for ants, which destroy much wood but aid in soil formation, must be given due credit. This is a good example showing how difficult it is correctly to estimate the economic value of many animals. Certain chemical and physiological considerations do not favor the idea that sour or fermented sap causes drunkenness in Sapsuckers.

The preceding discussion shows that there are many and marked evidences of the influence of birds upon the forest vegetation of the Adirondacks. This influence is on the whole very valuable to both the State and to private individuals, particularly because of the aid which it gives in hastening reforestation on burned lands. This aids in the conservation of soil and water, and makes the conditions more favorable for game and fish, and, last but not least, makes the region much more attractive to summer visitors, as few persons care to visit burned desolate areas.

Foresters are coming to agree that in the Adirondacks large areas should be permanent protection forests, to conserve soil and water, and where no cutting of trees should be allowed; these to remain wild forests, composed largely of spruce. In what manner do birds influence these forests? Still other large tracts ought to be preserved as natural "monuments," and as a wild preserve for the preservation of sample areas of wild plants and animals for educational and scientific purposes. These areas should include the main kinds of native vegetation, mixed hardwood forests, and swamps, not already included within the protection-forests, and should be supplementary to them. These should be preserved for their scenic, educational, scientific value, and for the scientific study of certain forest problems. What is the relation of birds to such forests? A third kind of forest land includes that which should be managed to produce the best possible crop of commercial forest. This might include spacious areas away from the larger streams and lakes. This part should be so managed as to pay much toward the upkeep of the forest, fish and game interests, as well as being a playground, and should be so conducted that the ordinary citizen may easily enjoy it. What is the relation of birds to this kind of a forest?

It is hoped that in the future woodland birds will be more thoroughly investigated from the standpoint of their relation to forests broadly considered. Such investigations should be detailed and include a careful study of the life activities of the birds, including their food, nesting habits, enemies and relative abundance in wild and modified forests under every possible condition, as in clearings, in lumbered forests, in all stages of the different systems of reforestation, and under the various systems of forest management. Further similar studies should be made of forested game preserves and the various systems of management of large forested parks and other woodlands. In given conditions, say five acres, how many birds normally live, how can their numbers be increased or decreased, and what desirable changes can be made in such a bird community? Strange as it may seem, not a forest-inhabiting species

of bird in North America has been thoroughly studied according to such a program, and thoroughly related to forest practice. Here is an immense field of work for properly trained men who wish to put this phase of forestry upon a thoroughly sound, scientific, and economic basis.

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RELATION OF MIGRATORY BIRDS TO FORESTS, THE
STATE AND THE NATION

"The necessity of the preservation of bird life to the continuance of the life of our national forests, and of the preservation of our agricultural resources or, in other words, the dependence of forest and plant life upon bird life, is thus demonstrated."

LOUIS MARSHALL.

Brief to Supreme Court of the United States,
October Term, 1919, No. 609, p. 41.

"On December 8, 1916, a treaty between the United States and Great Britain was proclaimed by the President. It recited that many species of birds in their annual migrations traversed many parts of the United States and of Canada, that they were of great value as a source of food and in destroying insects injurious to vegetation, but were in danger of extermination through lack of adequate protection. * * * Wild birds are not in the possession of anyone; and possession is the beginning of ownership. The whole foundation of the State's rights is the presence within their jurisdiction of birds that yesterday had not arrived, tomorrow may be in another State, and in a week a thousand miles away.

"Here a national interest of very nearly the first magnitude is involved. It can be protected only by national action in concert with that of another power. The subject matter is only transitorily within the State and has no permanent habitat therein. But for the treaty and the statute there soon might be no birds for any powers to deal with. We see nothing in the Constitution that compels the Government to sit by while a food supply is cut off and the protectors of our forests and our crops are destroyed. It is not sufficient to rely upon the States. * * * We are of opinion that the treaty and statute must be upheld."

JUSTICE HOLMES.

Decree, Supreme Court of the United States,
October Term, No. 609, 1919.

THE SUMMER BIRDS OF THE ADIRONDACKS IN FRANKLIN COUNTY, N. Y.

BY THEODORE ROOSEVELT, JR., AND H. D. MINOT.

The following catalogue (written in the mountains) is based upon observations made in August, 1874, August, 1875, and June 22d to July 9th, 1877, especially about the Saint Regis Lakes, Mr. Minot having been with me, only during the last week of June. Each of us has used his initials in making a statement which the other has not verified.

THEODORE ROOSEVELT, Jr.

The general features of the Adirondacks, in those parts which we have examined, are the many lakes, the absence of *mountain*-brooks, the luxuriant forest-growth (the taller deciduous trees often reaching the height of a hundred feet, and the White Pines even that of a hundred and thirty), the sandy soil, the cool, invigorating air, and both a decided wildness and levelness of country as compared with the diversity of the White Mountain region.

The *avifauna* is not so rich as that of the latter country, because wanting in certain "Alleghanian" birds found there, and also in species belonging especially to the Eastern or North-eastern Canadian fauna. Nests, moreover, seem to be more commonly inaccessible, and rarely built beside roads or wood-paths, as they often are in the White Mountains. M.

1. Robin. *Turdus migratorius* (Linnæus). Moderately common. Sometimes found in the woods.
2. Hermit Thrush. *Turdus Pallasi* (Cabanis). Common. Sings until the middle of August (R.).
3. Swainson's Thrush. *Turdus Swainsoni* (Cabanis). The commonest thrush.
4. Cat-bird. *Mimus Carolinensis* (Linnæus). Observed beyond the mountains to the northward, near Malone.
5. Blue Bird. *Sialia sialis* (Linnæus). Common near Malone.
6. Golden-crowned "Wren." *Regulus satrapa* (Lichten.). Quite common; often heard singing in June.
7. Chickadee. *Parus atricapillus* (Linnæus). Rather scarce in June. Abundant in August (R.).
8. Hudsonian Chickadee. *Parus Hudsonicus* (Forster). Found in small flocks at Bay Pond in the early part of August (R.).
9. Red-bellied Nuthatch. *Sitta Canadensis* (Linnæus). Common. The White-bellied Nuthatch has not been observed here by us.
10. Brown Creeper. *Certhia familiaris* (Linnæus). Common.
11. Winter Wren. *Troglodytes hyemalis* (Vieillot). Moderately common.

12. **Blue Yellow-backed Warbler.** *Parula Americana* (Linnæus). Very common. The Black and White Creeper we have not seen here.

13. **Nashville Warbler.** *Helminthophaga ruficapilla* (Wilson). Not common.

14. ?**Tennessee Warbler** *Helminthophaga peregrina* (Wilson).

15. **Yellow Warbler.** *Dendræca æstiva* (Gmelin). Common near Malone

16. **Black-throated Green Warbler.** *Dendræca virens* (Gmelin). Common.

17. **Black-throated Blue Warbler.** *Dendræca cerulescens* (Linnæus). Common.

18. **Orange-throated Warbler.** *Dendræca Blackburniæ* (Gmelin). Common. Its song has several rather misleading variations.

19. **Yellow-rumped Warbler.** *Dendræca coronata* (Linnæus). Common in August (R.). Summer-resident in the White Mountains (M.).

20. **Black and Yellow Warbler.** *Dendræca maculosa* (Gmelin). Not common.

The following other *Dendræcæ* are summer-residents in the White Mountains : Prairie Warbler, accidental ; the Chestnut-sided, Bay-breasted, Black-polled, and Pine Warblers, all rare (M.).

21. **Golden-crowned "Thrush."** *Siurus auricapillus* (Linnæus). Quite common.

22. **Water "Thrush."** *Siurus naevius* (Boddaert). Rare summer-resident (R.).

23. **Maryland "Yellow-throat."** *Geothlypis trichas* (Linnæus). Hardly common. Very common in the White Mountains (M.).

24. **Mourning Warbler.** *Geothlypis Philadelphica* (Wilson). Locally not uncommon.

25. **Canada "Flycatcher."** *Myiodiocetes Canadensis* (Linnæus). Less common than in the White Mountains, where the Redstart also is found, even at Bethlehem (M.).

26. **Scarlet Tanager.** *Pyranga rubra* (Linnæus). Two pairs found in June near the Upper Saint Regis Lake.

27. **Barn Swallow.** *Hirundo horreorum* (Barton).

28. **Cliff Swallow.** *Petrochelidon lunifrons* (Say). Seen near Malone.

29. **White-breasted Swallow.** *Tachycinetes bicolor* (Vieillot). Common, and met with far from any buildings.

30. **Bank Swallow.** *Cotyle riparia* (Linnæus). Rather rare.

31. **Purple Martin.** *Progne subis* (Linnæus). One seen at Malone.

32. **Cedar-bird.** *Ampelis cedrorum* (Vieillot). Common.

33. **Red-eyed Vireo.** *Vireo olivaceus* (Linnæus). Very common.

34. **Solitary Vireo.** *Vireo solitarius* (Wilson). Very common. The Warbling Vireo has not been observed here by us.

35. **Purple Finch.** *Carpodacus purpureus* (Gmelin). Common.

36. **Red Crossbill.** *Loxia curvirostra* (Linnæus). Not rare. The male often sings somewhat like a Purple Finch from the top of a tall dead tree. The White-winged Crossbill we have not seen here.

37. **Goldfinch.** *Chrysomitris tristis* (Linnæus). Common. Less so than in the White Mountains (M.).

38. **Siskin.** *Chrysomitris pinus* (Wilson). One specimen got, August 27th, 1874 (R.). Probably breeds.

39. **Savannah Sparrow.** *Passerculus savanna* (Wilson). Apparently rare.

40. **Bay-winged Sparrow.** *Poæcetes gramineus* (Gmelin). Common.

41. **Song Sparrow.** *Melospiza meloda* (Wilson). Common. Much less so than in the White Mountains (M.).

42. **Swamp Sparrow.** *Melospiza palustris* (Wilson). Two or three were found in the wet ground, covered with very low shrubs, which borders the stream connecting Upper Saint Regis and Spitfire Lakes. Perhaps not found in the White Mountains (M.).

43. **Chipping Sparrow.** *Spizella socialis* (Wilson).

44. **?Field Sparrow.** *Spizella pusilla* (Wilson).

45. **White-throated Sparrow.** *Zonotrichia albicollis* (Gmelin). Common.

46. **Snow-bird.** *Junco hyemalis* (Linnæus). Common. Less so than in the White Mountains, at least than in the northern and western parts, where the Canadian fauna is most marked (M.). This opportunity is taken for mentioning that the Rose-breasted Grosbeak, *Goniaphea Ludoviciana* (Linnæus), was seen in July, 1875, on Mount Mansfield, Vt., and in July, 1877, in Essex County, New York (R.).

47. **Bobolink.** *Dolichonyx oryzivorus* (Linnæus). Several seen, August, 1874 (R.).

48. **Cow-bird.** *Molothrus ater* (Boddaert). Rare.

49. **Red-winged Blackbird.** *Agalæus phœniceus* (Linnæus). By no means abundant.

50. **Rusty Blackbird.** *Scolecophagus ferrugineus* (Gmelin). Two or three seen in June (M.).

51. **Crow Blackbird.** *Quiscalus purpureus* (Bartr.) var. *æneus* (Bd.). Neither rare nor common. The Baltimore Oriole is not seen here.

52. **Raven.** *Corvus corax* (Linnæus). A pair were observed at Lake Farnsby, jr., August, 1874 (R.).

53. **Crow.** *Corvus Americanus* (Audubon). Comparatively uncommon.

54. **Canada Jay.** *Perisoreus Canadensis* (Linnæus). Locally common in the thicker woods.

55. **Blue Jay.** *Cyanurus cristatus* (Linnæus). Moderately common.

56. **King-bird.** *Tyrannus Carolinensis* (Linnæus). Common.

57. **Great Crested Flycatcher.** *Myiarchus crinitus* (Linnæus). Very rare.

58. **Pewee.** *Sayornis fuscus* (Gmelin).

59. **Wood Pewee.** *Contopus virens* (Linnæus).

60. **Olive-sided Flycatcher.** *Contopus borealis* (Richardson). Not uncommon.

61. **Traill's Flycatcher.** *Empidonax Trailli* (Audubon). Rare.

62. **Least Flycatcher.** *Empidonax minimus* (Baird). Strikingly common, and much in tree-tops.

63. **Yellow-bellied Flycatcher.** *Empidonax flaviventris* (Baird). Rather rare, and a frequenter of shrubbery.

64. **Night "Hawk."** *Chordeiles Virginianus* (Gmelin).

65. **Whippoorwill.** *Antrostomus vociferus* (Wilson). One heard early in July (R.).

66. **Chimney Swift.** *Chaetura pelagica* (Linnæus). Common, and often met with in the wilds.

67. **Hummingbird.** *Trochilus colubris* (Linnæus). Rare; lives in the woods.

68. **Kingfisher.** *Ceryle alcyon* (Linnæus).
69. **Cuckoo.** *Coccyzus [erythrophthalmus (Wilson)?]*. Twice heard.
70. **Pileated Woodpecker.** *Hylotomus pileatus* (Linnæus). Rare, but found in the backwoods (R.).
71. **Hairy Woodpecker.** *Picus villosus* (Linnæus). Very common; with a great variety of notes, some of which are indistinguishable from those of the *Picoides*.
72. **Downy Woodpecker.** *Picus pubescens* (Linnæus). Once seen in June, and common in August (R.).
73. **Black-backed Woodpecker.** *Picoides arcticus* (Swainson) Common; second in numbers to the Hairy only.
74. **Banded-backed Woodpecker.** *Picoides Americanus* (Brehm) Much less common than the preceding.
75. **Yellow-bellied Woodpecker.** *Sphyrapicus varius* (Linnæus) Quite common.
76. **Golden-winged Woodpecker.** *Colaptes auratus* (Linnæus)
77. **Barred Owl.** *Syrnium nebulosum* (Forster) One shot in August, 1875 (R.). Probably not very rare.
78. **Great Horned Owl.** *Bubo Virginianus* (Gmelin) Common in wild parts (R.). There are doubtless other kinds of owls here as summer-residents.
79. **Goshawk.** *Astur atricapillus* (Wilson). Found in June.
80. **Cooper's Hawk.** *Nisus Cooperi* (Bonaparte).
81. **Sharp-shinned Hawk.** *Nisus fuscus* (Gmelin). The Sparrow Hawk and the Red-shouldered Buzzard we have not seen here.
82. **Red-tailed Buzzard.** *Buteo borealis* (Gmelin).
83. **Broad-winged Buzzard.** *Buteo Pennsylvanicus* (Wilson). One shot August 24th, 1874 (R.).
84. **Bald Eagle.** *Haliaëtus leucocephalus* (Linnæus). Rare, but seen at least once (R.). The Golden Eagle probably occurs here.
85. **Fish Hawk.** *Pandion haliaëtus* (Linnæus). Rare, but certainly breeds here (R.).
86. **Wild Pigeon.** *Ectopistes migratorius* (Linnæus). Undoubtedly to be found here at times.
87. **Canada Grouse.** *Tetrao Canadensis* (Linnæus). In some parts quite plentiful (R.).
88. **Ruffed Grouse.** *Bonasa umbellus* (Linnæus). Not uncommon (R.).
89. **Woodcock.** *Philohela minor* (Gmelin). In July, one was shot at Paul Smith's; none of the inhabitants knew what it was, or had ever seen another (R.).
90. **Spotted Sandpiper.** *Tringoides macularius* (Linnæus).
91. **Great Blue Heron.** *Ardea herodias* (Linnæus). Rare.
92. **Bittern.** *Botaurus mugilans* (Bartram). Occasional (R.)
93. **Black Duck.** *Anas obscura* (Gmelin). Breeds (R.).
94. **Wood Duck.** *Æx sponsa* (Linnæus). Breeds (R.)
95. **Merganser.** *Mergus [serrator (Linnæus)?]* Breeds (R.)
96. **Loon.** *Colymbus torquatus* (Brünnich). Rare, but in 1876 common (R.). Grebes have been seen in August; species uncertain (R.)
97. **Herring Gull.** *Larus argentatus* (Brünnich) Rare Breeds (R.).

CURRENT STATION NOTES

ADIRONDACK BIRDS

This number of the *Bulletin* is devoted to the birds of the western Adirondack region. The modern view of the relation of birds to the forest is well expressed by the quotations given on p. 520.

That one of the earliest writings of Theodore Roosevelt was a joint paper with his friend H. D. Minot, on "The Summer Birds of the Adirondacks in Franklin County, N. Y.," will surprise many who have not realized how much at heart Roosevelt was a wild life enthusiast. The paper was written when Roosevelt was 17 years old and as he states "in the mountains." In the "Bulletin of the Nuttall Ornithological Club," Vol. 3, p. 36, 1878, then the leading ornithological publication in America, reference was made to this paper as follows by Dr. J. A. Allen: "Messrs. Roosevelt and Minot have published a very acceptable list of the summer birds of the Adirondacks, embracing ninety-seven species, with short notes respecting their abundance,—the first list known to us of the summer birds of this ornithologically little-explored region.—J. A. A."

In Mrs. Corinne Roosevelt Robinson's very interesting volume, "My Brother Theodore Roosevelt," on pages 100-101, she refers to this paper and reproduces the first page of the paper. Its rarity and inaccessibility has suggested that it be reproduced exactly, with the assurance that it will be heartily welcomed by many.

ADIRONDACK WILD LIFE

In addition to the investigations of Adirondack birds the Station made a study of the status of beaver in Hamilton and Herkimer Counties, the results of which were published in the preceding number of the *Bulletin*. The demand for this report has been so great that the small edition for general distribution was exhausted within three months after its appearance. This study of the beaver should be extended throughout the Adirondacks. It is known that the beaver influences both deer and trout, and other animals of the forest. Again we are reminded of the urgent need of an intensive study of the deer. It is indeed surprising that an animal of so much interest and importance should receive relatively slight study in the Adirondacks.

During the past summer (1922) Mr. Alexander Macdonald, Commissioner, New York State Conservation Commission, invited the cooperation of the Roosevelt Station in a study of the trout of the vicinity of Cranberry Lake in the Western Adirondacks. There exists considerable diversity of opinion among the residents as to

the best policy with regard to the trout in that vicinity. The large lake and the inflowing Oswegatchie River make an unusual combination of conditions which are particularly favorable for the production of large trout. In fact, the region is reported to include the best trout waters in the Adirondacks, and naturally their importance justifies most careful study.

A field party from the Station consisting of four men made a preliminary reconnaissance of the situation during September with the idea of preparing plans for continuing the study in the spring.

THE ROOSEVELT WILD LIFE MEMORIAL

As a State Memorial

The State of New York is the trustee of this wild life Memorial to Theodore Roosevelt. The New York State College of Forestry at Syracuse is a State institution supported solely by State funds, and the Roosevelt Wild Life Forest Experiment Station is a part of this institution. The Trustees are State officials. A legislative mandate instructed them as follows:

"To establish and conduct an experimental station to be known as 'Roosevelt Wild Life Forest Experiment Station,' in which there shall be maintained records of the results of the experiments and investigations made and research work accomplished; also a library of works, publications, papers and data having to do with wild life, together with means for practical illustration and demonstration, which library shall, at all reasonable hours, be open to the public." [Laws of New York, chapter 536. Became a law May 10, 1919.]

As a General Memorial

While this Memorial Station was founded by New York State, its functions are not limited solely to the State. The Trustees are further authorized to cooperate with other agencies, so that the work is by no means limited to the boundaries of the State or by State funds. Provision for this has been made by the law as follows:

"To enter into any contract necessary or appropriate for carrying out any of the purposes or objects of the College, including such as shall involve cooperation with any person, corporation or association or any department of the government of the State of New York or of the United States in laboratory, experimental, investigative or research work, and the acceptance from such person, corporation, association, or department of the State or Federal government of gifts or contributions of money, expert service, labor, materials, apparatus, appliances or other property in connection therewith." [Laws of New York, chapter 42. Became a law March 7, 1918.]

By these laws the Empire State has made provision to conduct forest wild life research upon a comprehensive basis, and on a plan as broad as that approved by Theodore Roosevelt himself.

Form of Bequest to the Roosevelt Wild Life Memorial

I hereby give and bequeath to the Roosevelt Wild Life Forest Experiment Station of The New York State College of Forestry at Syracuse, for wild life research, library, and for publication, the sum of, or the following books, lands, etc.

VOLUME 21

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AT

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The Serial Publications of The Roosevelt Wild Life Forest Experiment Station consist of the following:

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These publications are edited in cooperation with the College Committee on Publications.

Exchanges are invited.

CHARLES C. ADAMS

Director and Editor



Compliments of Chas. C. Adams.

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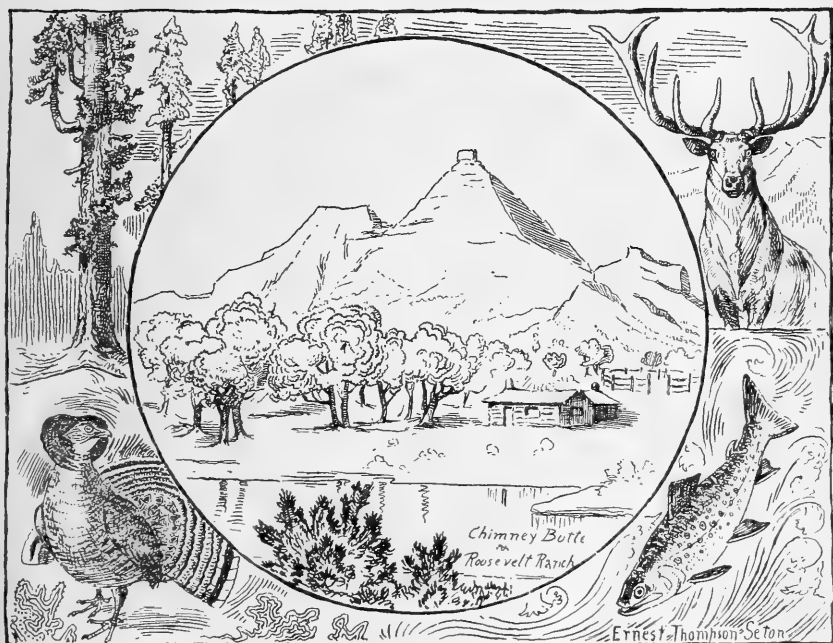
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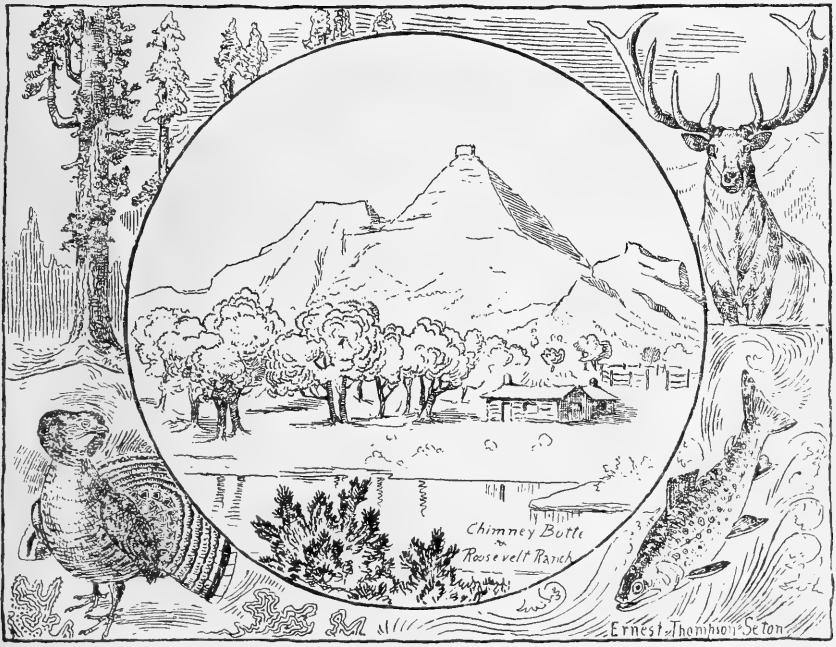
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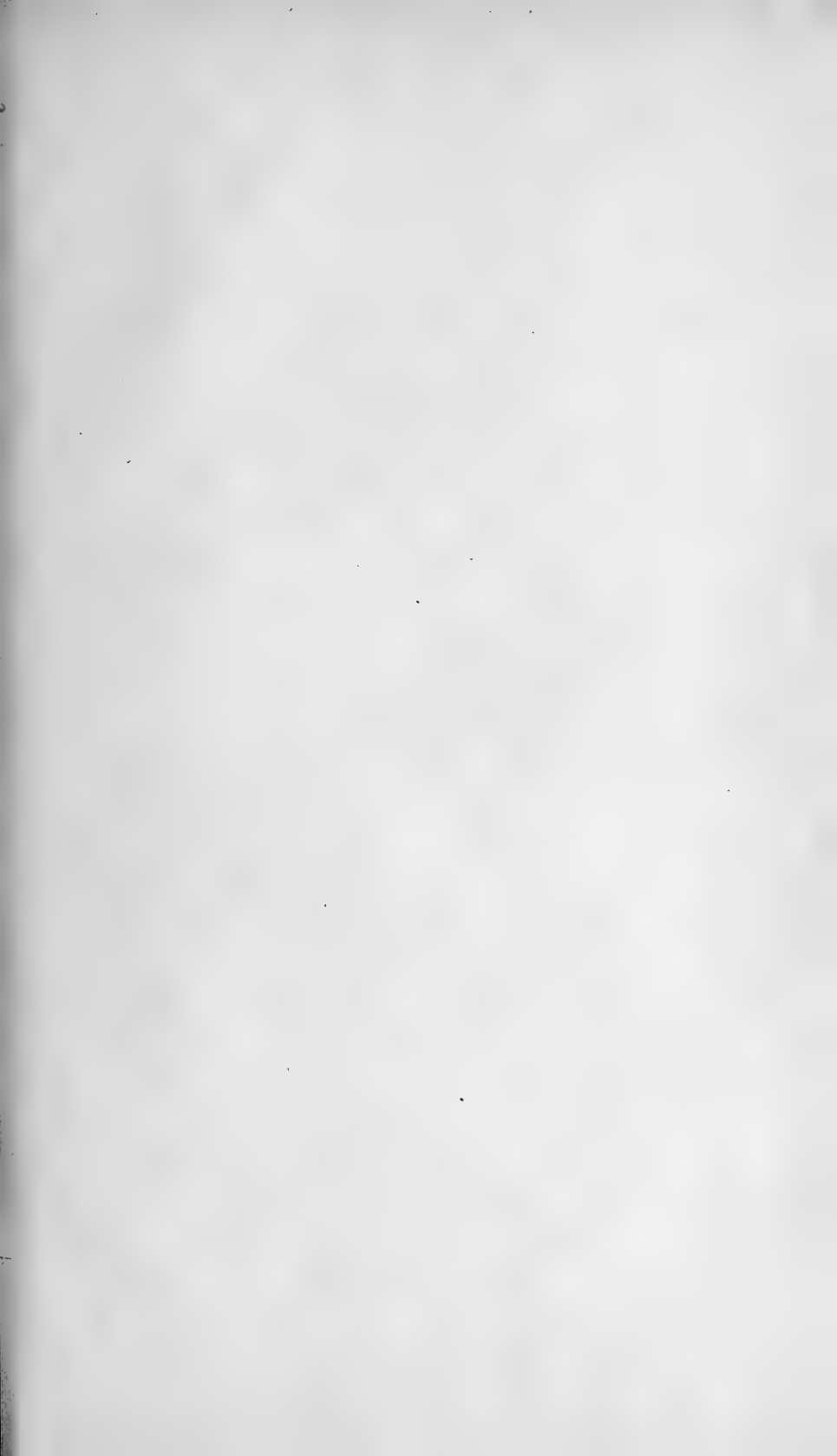
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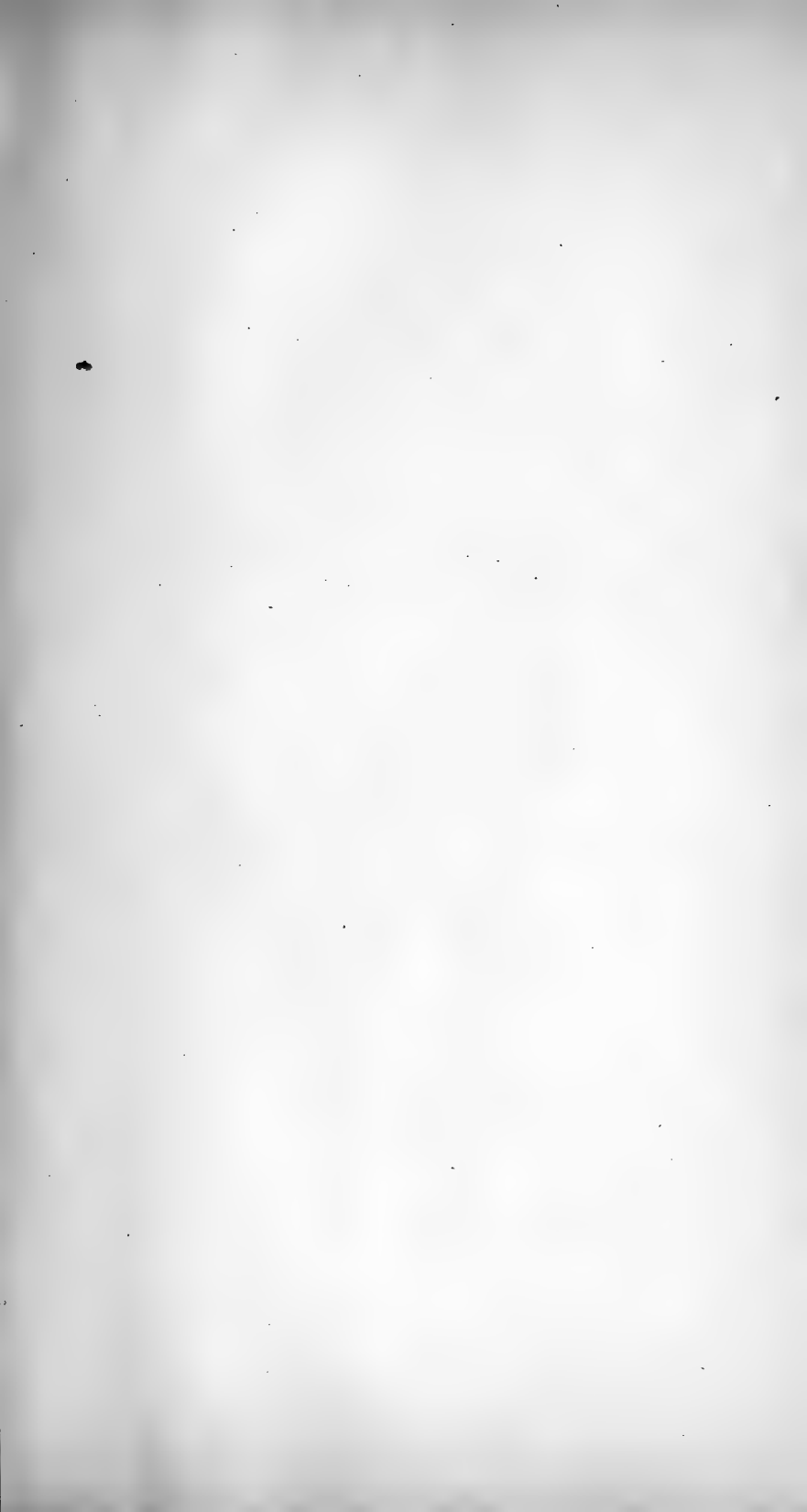
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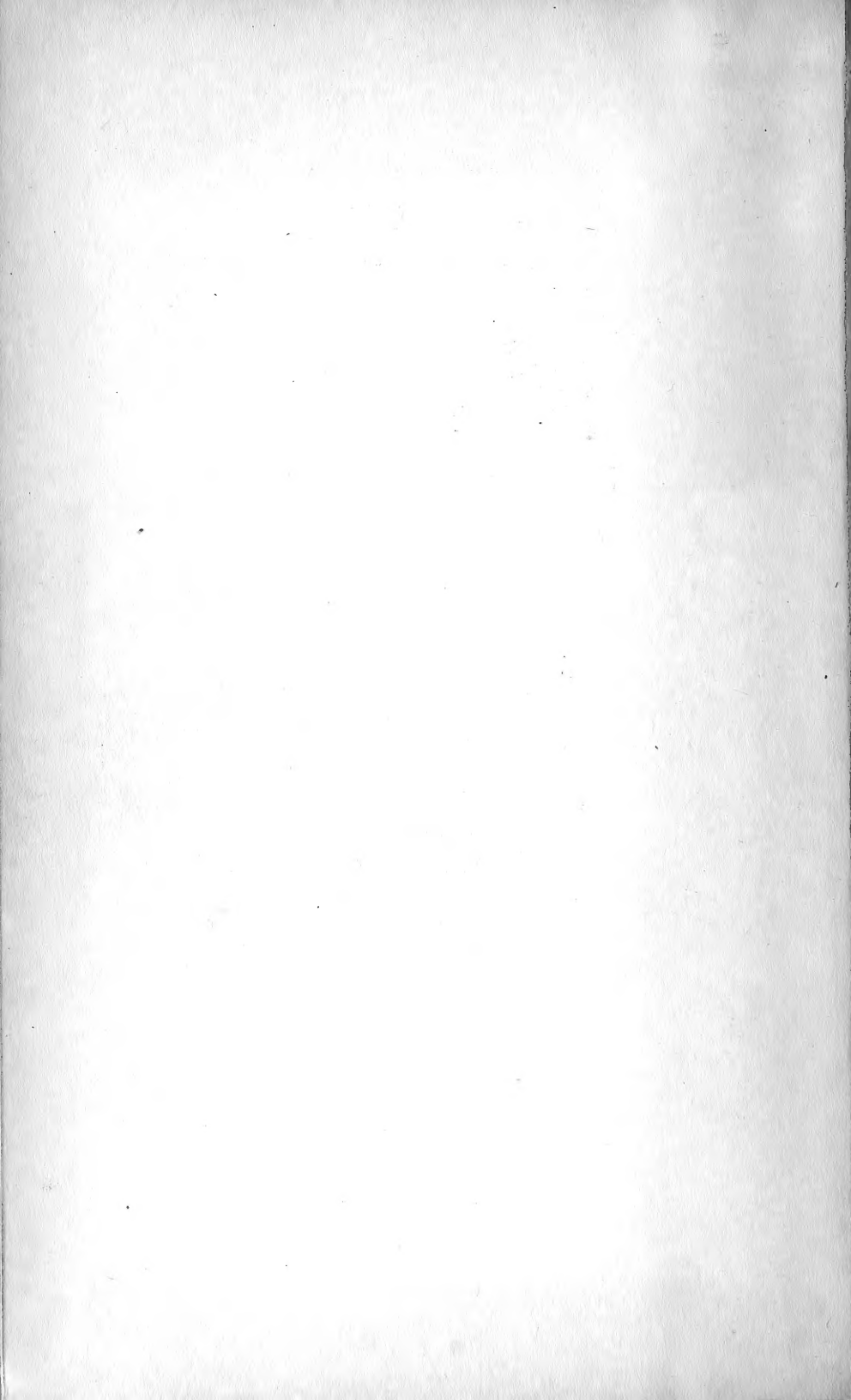
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